





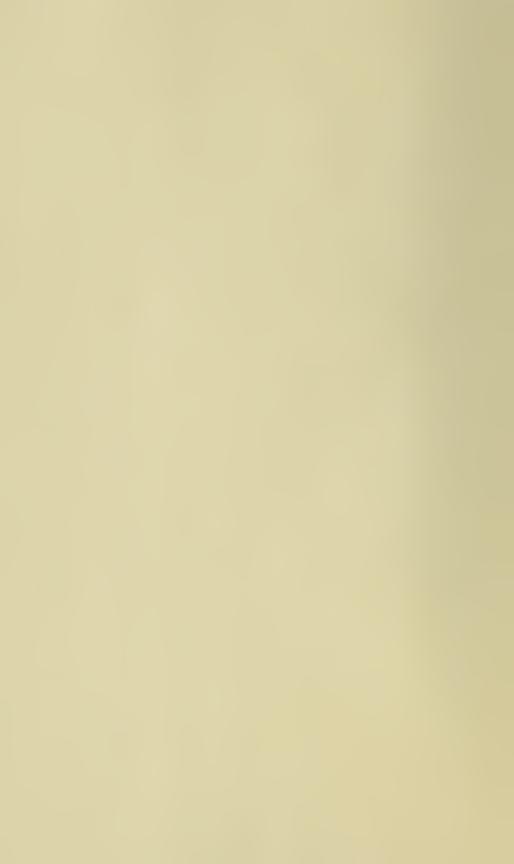


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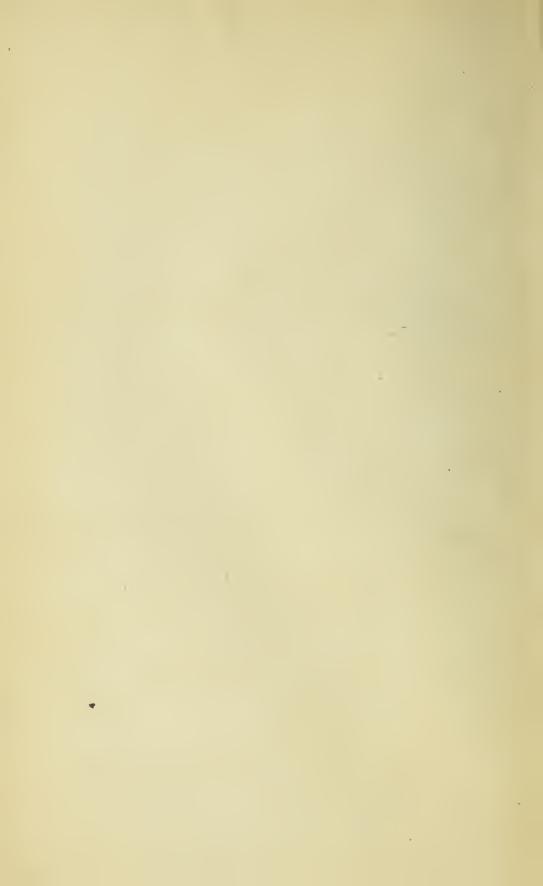












PRACTICAL OBSERVATIONS

on

CONICAL CORNEA,

AND ON THE

SHORT SIGHT,

AND

OTHER DEFECTS OF VISION CONNECTED WITH IT.

вv

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LONDON:

JOHN CHURCHILL. LIVERPOOL: DEIGHTON & LAUGHTON. 1854.

Nothingham

"Nur die Fülle führt zur Klarheit Und in Abgrund wohnt die Wahrheit." T0

THE MEMORY

OF

Nalrymple,

THESE PAGES ARE MOST RESPECTFULLY DEDICATED,

AS A TRIBUTE OF ADMIRATION FOR

DEPARTED GENIUS,

AND FOR EXCELLENCE ASSOCIATED WITH A NAME WHICH IS ALREADY INSCRIBED UPON MONUMENTS

OF MORE DURABLE CHARACTER.

ERRATUM.

Page 3, line 14, for "less," read "more."

PREFACE.

The observations contained in the following pages relate to—

- 1. The symptoms and physical characteristics of conical cornea.
- 2. The modes of origin of this malady, in connection with which it is viewed as a result, in most instances, of inflammatory action, although this antecedent may not, at all times, be observed.
- 3. The concurrence of other diseases of the visual apparatus, or of distant organs.
- 4. The progress and terminations of the affection.
- 5. The treatment: in some measure for the purpose of showing that surgical operations

can only be of service in a few exceptional cases, and that optical instruments, in the earlier stages, or less developed forms of the disease, may be of great use.

- 6. The anatomical changes associated with the affection which require elucidation by observations more numerous than have hitherto been made.
- 7. Certain other morbid conditions of the eye, directly or indirectly connected with the subject of conical cornea, or capable of throwing light on the origin, nature, diagnosis, or treatment of this disease.
- 8. The possible occurrence of the malady amongst the lower animals, as a matter worthy of the attention of pathological inquirers.

The writings of ophthalmologists of the most cultivated nations have been more or less consulted, both in human and comparative medicine, and their observations as frequently quoted; and obligations to English and French, German, Dutch, Belgian, and

Italian authors, should be more especially acknowledged. To Danish writers I am somewhat indebted, less to Swedish, least of all to Spanish and Portuguese; it should, however, be mentioned, that some of the excellent Spanish treatises on comparative medicine and surgery, such as those of Sampedro, Casas, and Santos, have been carefully consulted, previous to the expression of opinions respecting the occurrence of conical cornea amongst the lower animals. But, before closing this notice of obligation, especial mention should be made of the original observations of Dr. Pickford, of the late Mr. Walker of Manchester, of Mr. Middlemore and Mr. Gervis, of the valuable monograph on conical cornea of Mr. W. W. Cooper, (not to mention many names of equal merit in France, Germany, and Italy, and which may be found in the following pages,) and last, but not least, of the profound work of Stellwag von Carion, and the methodic and beautiful treatise of the brilliant Cappelletti; a name, in connection with which it may be remarked, that the practice of Italian surgeons, in this department of ophthalmology, has been relatively little noticed by writers on the subject in other European countries, although Italian observations have been numerous, curious, and scientific, doing honour to a land once

"Sacred to the Gods,"*

and even now, a favoured abode of Genius dwelling amongst men.

My best thanks are due to my Liverpool publishers,—Messrs. Deighton & Laughton,—for their ample supply of the most recent English and Foreign works on Ophthalmology, by which my wants have often been anticipated, and the observations on the subject-matter of this essay considerably extended.

LIVERPOOL, June 1, 1854.

* "Italia diis sacra."

C. PLINII, Lib, iii.

PRELIMINARY REMARKS.

In the year 1748, Mauchart published, at Tubingen, a Dissertation on Conical Cornea, or "Staphyloma Diaphanum," as he terms it; and in 1766, Taylor, in his "Nova Nosographia Ophthalmica," published at Hamburg and Leipzig, has concisely described the same disease, under the name "Ochlodes;" the remarks, however, of these authors do not seem to have attracted much attention, for even the learned Scarpa, in his work published at Pavia in 1801, in a long note connected with the article Staphyloma, describes a case of conical cornea in a female, which had recently come under his observation, saying, that if it were not referred, in classification, to staphyloma, he could not tell where, amid ophthalmic

diseases, to place it; while he makes no allusion to the descriptions of Mauchart, or Taylor, but speaks of the affection in such manner as leads the reader to suppose that he had neither seen nor read of it before.

By the case of Scarpa, however, this malady of the cornea was again introduced to the notice of surgeons, and his account of it was too graphic, clear, and complete, to be lost upon the book-shelves, as those of earlier observers had been, while the fame of his writings, with their English, German, and French translations, spread a knowledge of the matter in all countries where the healing art is rationally cultivated. By some English writers, the merit of this so-called first notice of conical cornea, has been given to Léveillé, the French translator: the note in his translation which corresponds to that in the original of Scarpa having been accidentally, but erroneously, regarded as an addition made to the French version of the work; it is somewhat remarkable that such a mistake should have

been made in this country, and even at a time when an excellent English translation of Scarpa's treatise presented the note in question in plain English dress; while no one seems to have given to Briggs, the English, or to Martens, the German translator, the credit or the compliment which fell to the lot of Léveillé; the error, however, was first started with a name of some authority, and on that account, perhaps, was longer and more readily copied.

The causes, nature, and treatment of conical cornea have not yet been illustrated by observations sufficiently numerous and varied to enable us to consider that this ocular malady is as well understood as are many other complaints that attack the organ of vision; hence it is obvious, that additions to our store of materials for the study of this affection seem to be more in request than are attempts at anything like systematic treatises on the subject: the morbid anatomy of the disease is the department in which accurate information is most scanty; having, in itself, no tendency to destroy, or to shorten life, oppor-

tunities for observing its vestiges, post mortem, have hitherto been exceedingly rare; for, although much that relates to the anatomical state of the cornea may be plainly seen by the observer during life, this, in the main, belongs to the external or anterior surface of the tunic, while the posterior surface, as well as the intervening structure containing the true corneal lamina, are nearly out of the reach of satisfactory observation, so long as their transparency remains undisturbed.

The etiology of the disease is not more advanced than its pathology, although many very interesting observations have been made respecting the time of life, constitutional peculiarities, concomitant affections, general or local, as well as the influences of exposure or occupation of the eyes, which seem to have been noticed in connection with the origin or aggravation of the malady; some, however, of the conditions alluded to, may now and then be regarded as accidental, and, if so, must occasionally be viewed in the light of coincidence, rather than in that of cause.

The treatment of the disease has exercised a great amount of ingenuity, relatively more, perhaps, than most other affections which belong to the domain of surgery; for medicine, surgery, optics, and mechanics have been taxed for the production of therapeutic agents, capable of lessening or removing the serious defects of vision which this formidable disease of the eye, even in its earlier stages, or minor forms, is capable of producing; in the application of these, success has been various, and disappointment by no means rare; with one practitioner, general treatment has been fortunate; with another, local applications; a third has been gratified by the favourable results of a surgical operation; a fourth, with the improvement of vision effected by some optical or mechanical contrivance; in the hands of some, various combinations of these means have been wisely and usefully adapted, in accordance with the special conditions or particular forms of the malady; while others, having met with cases of unfavourable character, have tried, without any satisfactory result, even the most accredited methods of treatment.

It is worthy of remark, that scarcely any two practitioners have been equally fortunate with the same remedial means; this, however, may be accounted for in various ways, for cases of conical cornea are not only rare, but differ considerably in their nature; and it may be remarked, that differences in the size, form, and degree of transparency of the cone itself, would be sufficient to prevent similarity of results from any one plan of treatment, but more especially from the surgical or optical; and when, in addition to this, it is remembered that morbid conditions of the retina but too often accompany a conical state of the cornea, we see another grand source of disappointment with regard to effects of treatment, which cannot fail now and then to present a barrier to the surgeon's success; besides which it must be borne in mind, that the surgical operations performed for the relief of conical cornea, are unquestionably of the most delicate kind, including, as they have done, operations on the cornea itself, on the iris, and on the crystalline lens, and, in some instances, on more than one of the parts mentioned; so that occasional failure, never mind how well such operations may have been performed, belongs, of necessity, to the average results, and to the statistics of surgery; not to give more than a bare mention of the important fact, that, after surgical treatment of this refined cast is applied to an organ so exquisitely delicate as the eye, a great deal depends upon the patient and his friends; a little carelessness, rashness, or neglect, and the transparency of the cornea may be lost, or the interior of the eye destroyed by active inflammation. In the application of optical contrivances, numerous difficulties have to be overcome; a great variety of lenses and apparatus must be patiently tried, great care being taken not to allow fatigue of the eyes by efforts too long continued, or by instruments injudiciously selected; various minutiæ must here be attended to, and while careful trials will sometimes be amply

rewarded, those hastily made may as frequently end in disappointment.

To the treatment proposed and advocated as successful by some, others have raised very strong objections; these have related more especially to the applications of operative surgery; some writers avowing that, in cases of conical cornea, no benefit will accrue from the performance of any operation upon the eye; while compression of the eyeball, puncture of the cornea, the formation of artificial pupil, and operations on the lens, to say nothing of various combinations of these proceedings, have all had their opponents as well as advocates; it should, however, be borne in mind, that certain curative plans may be rationally or well suited to a given stage of the disease, but not equally applicable to all; and that certain operations, which appear in some cases to be indicated by what we may term the optical condition of the eye, might be performed, and nevertheless fail in producing any improvement of vision, by virtue of alterations in the vital condition of the organ, produced by the operation itself, and from which the eye is not able sufficiently to recover; the mechanical or optical rationale of the proceeding being all the while without fault; provided the vital condition of the eye, and the probable effects of interfering with it, had been more correctly appreciated.

The observations on conical cornea which the accompanying pages contain have no pretension to be regarded as a treatise on the subject; they are not, therefore, associated with any limited theoretical views respecting the causes or nature of this malady; the individual cases, original or selected, are stated with all the attainable particulars relating to them, and some of them accompanied by remarks which their special characteristics seemed naturally to suggest; an addition to the store of materials in this branch of surgical literature being the object more especially kept in view. Some cases, which depart a little from the genuine forms of conical cornea, have been noticed, and certain sources of morbid action in the cornea, and other parts of the eye, connected,

apparently, with disturbance of the fifth cerebral nerve, have received that attention which their importance seems to merit.

As there is, comparatively, so little to be found relating to this interesting subject in the medical writings of any one country, it has seemed desirable to extend our means of information from various and distant sources.

In the surgical writings of some European countries, nothing relating to conical cornea is to be discovered; in those of some others only translated notices are met with; while, in the professional literature of Great Britain, Ireland, and America, of Germany, France, and Italy, the accumulated facts, with their physiological, pathological, and surgical comment, which show the light in which this subject should be viewed, the further studies required to elucidate it, and the practical importance attached to it, are for the most part to be found. The notices of the disease derived from observation of it in the East, but more especially in China, and mainly from

the pen of British, or American observers, have been published in this country as well as at Canton.

The malady does not seem to have been known to the ancients, for Hellenists find no satisfactory account of it in the writings of the Greeks; in the medical literature of Rome it is not mentioned; and Oriental scholars do not tell us of its especial notice in the books of the Hindoos or Arabians.

In some of the warmer countries of Europe it would seem to be little known, and in Spain it might be very rare, for in the "Manual de Afectos Esternos," of Garcia, it is not described; but this author, as a definition of staphyloma, says: "Se dá este nombre á la salida de la córnea trasparente, formando prominencia hácia adelante;"—a definition which would include what we call conical cornea, but this malady does not appear to have been contemplated by the author; and the surgical work of Don Jose Alarson gives no further information on the subject; but the surgeons of the peninsula have had better opportunities of studying this affection

vidal de Cassis has been published in the language of Castile.

In the surgical writings of Holland, perhaps the best account of the complaint is to be found in the Dutch translation of the work of Ruete, which has received additional value from the notes and comments of Donders.

In the Danish language, we find here and there observations and inquiries not altogether foreign to the subject; thus, in the beautifully-illustrated "Bidrag til Oiets Anatomie, Physiologie og Pathologie," of Hannover, the sections of various normal forms of the cornea, representing the curve of the transparent front of the eye in different animals, are characterised by an accuracy and beauty which do honour to the physiology and lithography of Denmark; while the report of results of experimental inquiry relating to the modified nutrition or destruction of the cornea after removal of the superior cervical ganglia of the sympathetic nerves, may be

regarded as an interesting step in the progress of an important inquiry, the whole length of which has not yet been travelled. In a more recent work of another distinguished physician of Copenhagen—the "Ophthalmologerne" of Brion—the phenomena of keratitis and its various consequences have received an attention in accordance with their importance.

In the Swedish Dictionary of Diseases of the Eye, "Ögonläkeren," a short notice of the malady is given under the word "Ochlodes," the appellation formerly adopted by Taylor; but there is little doubt that the Scandinavian writers have more important productions connected with this matter, with which time and literary intercourse may make us better acquainted, a notice of which, however, I do not find in the general bibliographical works of Sweden, Denmark, or Norway, nor in the "Bibliotheca Danorum Medica" of Winther.

In Germany, where ophthalmology, in general, has long been so profoundly studied, conical cornea appears to have attracted attention upwards of a century ago; one, however, of the earliest writers on the subject in the German language was not a native of Germany but of England.

There is too much in the medical writings of the Arabians that has never been multiplied by the typopraphic art, to allow of the unreserved assertion that the attention of their oculists, who were numerous and famed, was not directed to the subject of conical cornea. This statement may seem to require illustration, and the following notice, one out of many which might easily be adduced, will answer the purpose:—

A Latin translation of the Dresden manuscript of the Arabic work on the Anatomy, Physiology, and Diseases of the Eye of Alii Ben Isa, is in course of publication; hitherto, however, only a small portion has appeared, but this is sufficient to shew something of the general scope of the production; and what is more, as far as our inquiry is concerned, the table of contents for the pathological part, which is given in the introductory section, displays a certain amount

xxiii

of progress and refinement in connection with the division and arrangement of the diseases of the cornea, as the following short extract may show:—

- 1. De numero morborum strati corneæ.
- 2. De speciebus ulcerum eorumque tract.
- 3. De pustulis corneæ.
- 4. De nubecula et albugine ejusq. tract.
- 5. De pigmento nubeculæ et colore cæruleo oculi ejusq. tract.
- 6. De excoriatione (ulcere superfic.) corneæ.
- 7. De abscessu corneæ (hypopyo vero).
- 8. De carcinomate corneæ.
- 9. De excavatione (cicatricibus) corneæ.
- 10. De mutatione coloris corneæ ejusque tractatione.
- 11. De humiditate tunicæ corneæ.
- 12. De exsiccatione et corrugatione (rhytidosi, atrophia) tun. corneæ.
- 13. De pure pone corneam collecto (hypopyo spurio).
- 14. De discrimine inter protuberantiam (cerato-

cele, vel staphyloma corn. pellucidum) et pustulas (phlyctænas) corneæ.

15. De dissolutione unitatis (vulneribus) corneæ.

It is obvious that such study of diseases of the cornea as may be supposed to have been associated with the view of the subject which the above headings suggest, may have brought the "conical cornea" of modern writers under the attentive observation of the Arabic physician who flourished centuries ago; and even this short notice suggests, that we do not rightly neglect the science of Islam, and shows that if we care for the productions of Yemen, we must not confine ourselves to the Arabian Nights.

Some allusions have been made to the state of the cornea after operations upon the cerebral and sympathetic nerves, mainly to shew the different views of eminent physiologists on the subject; while it should be remembered, that operations which enable the inquirer to divide nervous cords within the skull, or in the depths of the neck, will often leave complicated and not easily defined injuries behind them, the general effects of which, as viewed in connection with those belonging to the especial aim of the operation, done, or intended to be done, it must always be difficult to analyse or to isolate.

The disease here treated of has been called by many different names; and it may be well to observe that, in the following pages, the terms "keratoconus" and "hyperkeratosis," when employed, are regarded as synonymous with conical cornea.

Some irregularities, in the concatenation of the materials of the following pages, have arisen from the reception of recent, and unexpected, continental works on ophthalmology, the subject matter of which, in connection with conical cornea, I was unwilling to leave without some little gleaning; and hence, in more than one place, have ceded the desired arrangement of facts to the accidental increase of their number, thus offending order, in a manner which requires some apology, and risking the applications of that just criticism which censures immethodic book-

making; this remark may also be received, in explanation of adding an index to an essay, for which, a table of contents, with better method, might have been regarded as sufficient.

The Bibliography of conical cornea has not hitherto any very great scope; the disease is, of course, noticed in all systematic works on ophthalmology, as well as in treatises on the pathological anatomy of the eye, and the monographs relating to it are mainly to be found in the English, German, French, and Italian languages.

ON CONICAL CORNEA.

It is familiar knowledge that the front of the eye is very differently shaped in different animals; that it is very flat in fishes, and flat, but in a less degree, in creatures that have their eyes sometimes under the water, and at others in the air, as in amphibia, and in some aquatic birds; that it is more rounded in the larger animals whose common abode is in the lower region of the atmosphere, in other words, upon, or near to the surface of the earth, as in the best known mammalia, and in many of the feathered tribe; while it is rounded in the extreme, and very prominent, in creatures that exercise vision, in a great measure, in the high-flying birds of prey.

It is obvious that these different forms of the eye are wisely adapted to the circumstances, or to the nature of the element, in which the beings possessing them are placed. The flat cornea of the

fish would not answer the purpose of rightly refracting the light passing from the air into the eye, if it
were found in lofty soarers, such as the eagle; while
the anteriorly prominent and rounded organ of this
visitant of the clouds would have been of equally
little use, had it been supplied to a creature inhabiting the depths of the ocean. Hence, it is easily
seen that the beings in question must require for
their varied abodes, in air or in water, modifications
of form in the organ of vision, as well as in the
apparatus of breathing, or in the machinery of
locomotion.

The human eye, with regard to its anterior rotundity, or form of the cornea, in the healthy state, may be said to hold a medium position between the prominent organ of the eagle, and the flattened one of the fish; but particular abnormal or morbid formations of the eye are now and then met with, in which, a something approaching to one or other of the types above alluded to, as peculiar to the eye of animals, may be observed as a characteristic of disease in the visual organ of man; want of rotundity, giving rise to flat cornea in an extreme degree, and without other disease, is uncommon, (although,

in a lesser degree, it is not rare,) but excess of prominence, giving rise to the state known as conical cornea, is not so unfrequent; in this class of cases the front of the eye, or cornea, has commonly an aspect of peculiar brilliancy, from the manner in which the light is reflected from it; and in connection with this fact, there is one instance on record, in which the presence of conical corneæ was regarded as an advantage, on account of the dazzling brilliancy which they gave to the countenance of a comedian, who had a fancied treasure in possessing a pair of eyes of this kind.

Conical cornea was first noticed in medical writings somewhat less than a hundred years ago, but its study was scarcely entered upon before the commencement of the present century; and the clinical facts of interest, out of which suggestions respecting its nature and treatment have sprung, are for the most part productions of the last twenty years.

Observations shew that it may affect the eye of the child before birth, and that in the other extreme the organ of vision of the aged may suffer from it, while intermediate ages are not exempted from its attack; youth, however, seems most favourable to it, and this more especially in girls, in whom, between the ages of 10 and 16, it is perhaps most frequently met with; and, as a general statement, it would be correct to say that it is very rarely originated after the body has received its full development.

It has been observed and treated of as occurring in the Mongolian and Caucasian branches of the human race, and in greater proportion in the former, as observations made in China tend to show; in the other varieties of mankind it has yet to be studied; it has been said not to occur in savages, but whether or no it affect them may very well be left for another generation to decide.

It has not yet been brought into the domain of comparative medicine, and veterinarians of eminence have said that they do not meet with it amongst domestic animals, and more especially is it affirmed that it rarely, if ever, occurs in the horse; in connection with this remark, however, the following observation may be made, which is, that although veterinarians in their systematic works have not specially devoted articles to conical cornea, they have nevertheless in other articles, such for instance as those on hydrops oculi, and staphyloma, here and there

described conditions, in appearance corresponding to the so-called conical cornea; in addition to which it must be remembered that the name, conical cornea, is comparatively recent in writings relating to human ophthalmology, and this more especially in some of the continental countries, amongst which France must be mentioned, where, until very lately, and in some cases even now, the account of this disease is to be found under the head of staphyloma, of which it is called the transparent variety, thus corresponding to the descriptions found in veterinary treatises.

If the disease were viewed in connection with country, climate, or season, it would be requisite, in the first place, to note the limit of the observations already made, which upon the whole must be regarded as narrow, when compared with those which belong to other branches of ophthalmology.

In some European countries, and to some practitioners, thousands of cases of ocular disease have occurred, without one sample of this malady being observed, and this for years together; and from various public notices and reports, it would seem that those surgeons who are most likely to have paid particular attention to the complaint have often

not had one case of it in a thousand, and have seldom exceeded three of it in a thousand; but a greater proportion than this has been observed in Asia, possible errors connected with nomenclature or definition being left for future consideration.

From observations hitherto made, it would seem that the disease is more frequent as we approach the tropics, and more rarely found in higher latitudes; but as the malady appears, in some cases at least, to be a consequence of inflammatory action, it is worthy of remark that its frequency in certain warm countries is perhaps to be accounted for by the greater prevalence of the ophthalmiæ of those regions.

It is said that the observers of North Britain, and of Northern Germany, have had very few opportunities of studying conical cornea, and that Himly, amongst others, had not seen a case when he wrote.

In Scotland it has been so rare, that out of 15,924 cases in the Glasgow Eye Infirmary, there were but 4 of conical cornea; nevertheless, Dr. Mackenzie has stated that "Sir David Brewster examined a great variety of cases of conical cornea."

Here it may be well to remark, that conical

cornea is a malady which does not in most instances diminish the clearness or brightness of the eye; hence those who suffer from it, not finding themselves troubled with any visible disease of the organ which they are able to appreciate, will doubtless, for the supposed weakness of the eye, very often seek relief in the aid of spectacles, and hence apply to the optician instead of the surgeon; and if so, the number of cases of conical cornea really existing in any community may not be adequately known by consulting surgical reports; to which we may add, that the fame of individual opticians may tend to lessen considerably the opportunities which neighbouring surgeons may have of observing or studying this interesting affection of the organ of vision; to these observations, however, must be added the remark, that opticians in different towns in the north of England have told me that they very rarely see a case of conical cornea.

Conical prominences of the cornea, with disease of its tissue, and with more or less of opacity, are not uncommon, as in cases of staphyloma; but that conical state of this part of the eye which is not generally associated with any loss of transpa-

rency, or other appreciable alteration of the tunic, if we except apparent and occasional modifications in its thickness or smoothness, is an exceedingly rare disease, and, as it often destroys distinct vision, while its nature and treatment are neither of them to be regarded as quite settled, any contribution to the clinical facts of this branch of ophthalmology may not be deemed unworthy of notice.

The following is a short account of a remarkable case of conical cornea, with which the patient could not distinguish the face of his friends, but where, by the adaptation of a peculiar optical contrivance, answering in some measure the purposes of an artificial iris, the sight was so much improved that he could afterwards read, without fatigue, a small newspaper type.

Mr. —, 23 years of age, of good constitution, tall, and thin, with fair complexion and blue eyes, says, that although not very strong, he has generally enjoyed good health, and that he knew nothing of the ocular complaint from which he now suffers until the age of about $14\frac{1}{2}$ years; at this time he grew very rapidly, and the defect in his vision, then first complained of, was attributed by his friends to

his recently rapid growth; since which, increase of it, rather than diminution, has progressed.

Even when he enters a room, if at all attentively observed, his eyes present a very peculiar appearance, their brightness being much greater than usual, and having something of that aspect which the eye of a child has, when a large and lucid tear is holding on its anterior surface; this appearance evidently depending upon the peculiar curve of the cornea, and the associated luminous reflection and refraction.

On the left side the cornea is conical, prominent, and perfectly transparent, its aspect rather favouring the idea that it is somewhat thinner than usual at its most prominent part, which part is a little to the outside of its centre, while at its base or sclerotic margin there is no evidence of deviation from the ordinary or healthy condition.

Supposing the crystalline system to be in its usual place, and regarding the aqueous humor as a lens, or as one of the refracting media of the eye, it is obvious that its antero-posterior measure is increased in proportion to the advance of the apex of the cone,—unless the cornea were much thickened at this part, which it does not seem to be. There

is no vestige of ulceration, or of inflammatory action in either cornea.

The state of the iris and pupil did not suggest any special pathological remarks, the former was vertical, the latter of the usual size.

To the right eye the above description also applies, but in this eye the conicity, which corresponds as to position, appears to be somewhat less than in the other.

Both eyes feel firm to the touch, and have their normal sensibility.

It would be shorter, and perhaps better, in few words to say, that amongst the objective phenomena of the case, two were mainly remarkable; one was the peculiarly glittering aspect of the prominent cornea, the other was an appearance of over sensitiveness in the eyes, when bright light fell upon them, giving rise to winking motions of the lids, with undue approximation of their margins.

When out of doors, in the sunshine, the patient is dazzled by the light, and cannot see any thing with distinctness; in the moderate light of a clouded day, or in an apartment, the vision is still defective, but the dazzling of course less.

To view small objects, the patient places them very near to his eyes, and a little to the temporal side. Mere double vision is not complained of, but a candle, when looked at, appears like a number of lights, confusedly running into one another; but without coloured fringes, or other phenomena of chromatic aberration.

The confusion, or want of vision, and the dazzling, are evidently attributable to the altered form of the anterior part of the eye-ball; so that the question at once suggests itself, What is the mechanical or optical contrivance most likely to correct in any measure the disturbing effects produced by the conical form of the cornea?

It was obvious that we had to contend with what may be called optical difficulties, arising from spherical aberration, in a case where no chromatic aberration was met with; and it is well known that the correction of the former, in instruments of human invention, is chiefly sought by modifications in the form of lenses, or by diminution of their aperture, while that of the latter requires a due selection and combination of the material of which lenses are composed. In the subsequent notice of the

treatment adopted in the case here related, it will be found, that the two methods of correcting spherical aberration, above alluded to, were both found to be useful.

- 1. It seemed probable, that darkened glasses, of double concave form, would be likely to assist the patient when walking in the street, on the supposition that their form might, in some small degree, meet the wants of the eye, while their colour would lessen the dazzling so much complained of.
- 2. The cylindric lens, of concavo-convex form, next suggested itself for correcting the effects produced by the before-mentioued curves of the cornea; and here it was well to bear in mind, that each cornea presented two curves, the extremities of which were on the same vertical plane, but the arcs of which were not of the same length; hence the concavo-convex cylindric lens seemed likely, in some measure, to answer our purpose; the curve of which could be placed vertically, so as to correspond with the shorter curve of the cornea; thus taking something from that which seemed to be the line of greatest refraction; the lesser refraction of the glass counteracting the greater refraction of the prominent anterior tunic of the eye.

3. It is obvious that the two instruments already noticed were intended to modify the effects of the light falling upon the whole of the cornea; the next which suggested itself was one which should alter the conditions under which vision might be exercised, by allowing the light to fall only upon a part of the cornea. To attain this end, a piece of black wood, in form more or less like the one-half of a walnut shell, was taken and perforated, so as leave a circular opening, beyond and around which a small nipple projected on the exterior, thus converting this hole into a very short tube, standing on the outer surface of the shell of wood, the aperture being, not in the centre, but a little to the inner side of this point; these black goggles being held before the eyes, the axes of their tubular apertures were convergent, more or less, as the axes of the eyes are when near objects are contemplated.

It may now be asked how these contrivances answered, or which of the three was the best; to which it might be replied that every one of the three was useful; the first, or darkened bi-concave lens, assisted the wearer very much when walking in the sunshine; and, as there was nothing disagreeable in

its appearance, was adopted and approved of, for reasons now explained: with the second or cylindric lens small newspaper type was read, to the great gratification of the gentleman; but while the optician was engaged with the glasses, the artificial iris was considered, and, when tried, found to be somewhat better than the last-mentioned lens.

The cylindric lens, in coloured glass, was not tried.

If the perforated cups of black wood had been less successful, a combination of artificial iris, with artificial lens, might have been tried; in other words, spectacles with very small glasses, surrounded by a broad and blackened rim of metal, wood, horn, ivory, or other opaque substance, would have suggested themselves.

The general health of the patient being good, and the defect of vision being so much alleviated by the instruments above noticed, it is obvious that further medical or surgical treatment was by no means indicated.

When we remember how little is known of the real causes of conical cornea, and at the same time bear in mind the varied characteristics which in different cases it presents, it need not seem surprising that many and very different methods of treatment should have been found useful in different instances, and hence strongly recommended for its cure.

Remedies administered by way of the stomach, topical applications to the eye and neighbouring parts, optical contrivances to assist the vision, surgical operations performed on the eye-balls, with the various combinations of these, may be said to include the main proceedings hitherto suggested; in connection with which it must be remarked, that in some cases benefit is only to be derived from a judicious combination of general and local treatment, or of operation and after-treatment.

1. As internal remedies tonics have been given, and also medicines which must generally be regarded as debilitating; such as sulphate of zinc and sulphate of magnesia, in combination. The dose, twenty grains of sulphate of zinc, with half an ounce of sulphate of magnesia, every morning, if circumstances permit, and the nausea or vomiting can be supported by the patient. Preparations of arsenic have in some cases been supposed to be beneficial, and the tincture of sesqui-chloride of iron,

with aloes and myrrh, carbonate of iron, and galbanum, are amongst the medicines of a long list.

2. Topical applications; amongst others those which are soothing, stimulant, astringent, or escharotic, have been employed. To the action of the former allusion need not be made; but with regard to the escharotic class, it may be stated, that the nitrate of silver, in substance, has been especially recommended to be applied to the apex of the morbid cone, when it is found that this apex is becoming opaque. It is said that this has occasionally done good, and it is not improbable that it might occasionally do harm.

Imponderable agents have been tried, especially electro-magnetism.

In. collyria, acetate and sulphate of zinc, as well as preparations of lead. Infusion of tobacco dropped upon the eye, has been recommended. In unguents, the nitric-oxide of mercury has had a place.

In cases where the apex of the cone had become opaque, the employment of the vapour of prussic acid has been followed by the diminution of the opacity.

Counter irritation has been produced, by blisters and various liniments to the back of the neck, or behind the ears, as well as to the temples or forehead; and nitrate of silver and tincture of iodine have been applied to the eyelids, with subsequent appearances of improvement.

Next may be mentioned the application of cold to the eye, or eyes, affected, as also that of pressure, as well as the combination of the two; for this refrigeration and pressure, various mechanical contrivances have been resorted to, - such as springs arching over the head, with their point d'appui on the occiput, holding, or holding and pressing, upon the fore part of the closed eye, ice, or other cooling substances, contained in capsules of animal membrane, bags of caoutchouc, &c., along with which there is the inconvenience of rapid rise in temperature, as well as the gradual loss of the fluid, of which some part in most cases soon escapes from the bag or capsule employed. Folds of linen dipped in cold water, and renewed at short intervals, have been recommended as especially useful, in cases of conical cornea associated with derangement of the catamenia. The apparatus of Langenbeck, or that of Chassaignac, is intended to facilitate the application of cold to the eyes; the former is a double

ring of horn or other substance, charged with ice, and placed over the eyes; the latter is a mask of iron wire, receiving little bags of ice, and holding them over the eyes, with the aid of a spring arched over the head, and by its expanded and cushioned extremity, holding on beneath the occipital protuberance.

Patients with alteration in the form of the cornea may be occasionally recommended to try whether vision is improved by gentle pressure or pulling on the eye-ball above, below, or laterally, practised with the end of the finger, applied to the integument near the canthus, or upon either of the lids.

Belladonna, or atropine, for dilating the pupil, may be mentioned amongst topical applications.

Amongst optical contrivances to assist the vision may be named artificial lenses, artificial irides, and combinations of the two; the bi-concave lens might seem to be indicated, but it is not always useful, and the bi-convex is very rarely tried; but even this has been said in certain rare cases to have been serviceable,—the meniscus might seem to promise better,—and glasses with one plane and one curved surface, are useful in diagnostic trials, and now and then might possibly be of service to the patient, either

alone, or in some of their combinations. A couple of plano-concave spherical lenses, the flat surfaces in juxta-position, with the curves crossing one another, has been found an useful combination.

Combinations of lenses of different figures, the ocular one bi-concave, the distal convex, with adjusting apparatus, have in some cases been of use. Lenses with posterior surface corresponding to the front of the eye, and anteriorly of regular figure, are amongst the means proposed for correcting the altered refraction; along with these may be mentioned lenses of transparent animal jelly, contained in capsules of glass, to be placed on the front of the eye, and kept there as long as the patient will bear spectacles of this kind.

The meniscus, with a bi-convex lens of unequal spheres behind it, has not been tried, but seems not unworthy of notice.

Should a case present itself in which the phenomena of chromatic, as well as those of spherical aberration are complained of, it is obvious that the optical correction might be sought in a combination of flint and crown glasses with different dispersive powers.

For determining the state of the vision, as well as for correcting its defects, not only should a variety of spherical lenses of equal and of unequal spheres be at hand, but those which are cylindric, parabolic, or hyperbolic, when procurable, may be useful; and some means of having them steadily supported are essential to accuracy and success.

The diaphragm, or artificial iris, may be plane or curved, with central or eccentric aperture, and with or without tubular prolongation in front of this; or, instead of the foramen, a slit.

In most cases, for viewing near objects, when both eyes are affected, the apertures seem best placed a little to the inside of the centre, and if in front of them there be a very short tubular prolongation, the pencil of rays will be more completely limited.

A combination of the diaphragm and lens, is now and then found useful in practice.

For the improvement of vision in cases of conical cornea, surgical operations have been performed with varied success upon the cornea itself, upon the iris, and upon the crystalline system, and occasionally upon more than one of these parts; their main objects have been two:—1. To lessen the

refracting power of the eye by flattening the cornea, or by removing the lens. 2. To improve vision by artificial pupil, made in some part of the rim of the iris, which corresponds to a transparent and circumferential part of the cornea, which is less rounded than its conical prominence, and not uneven, or otherwise diseased on its surface.

Flattening of the cornea has been attempted by different operations; puncture of this tunic, so as to let out a part of the aqueous humor, is generally followed by flattening of the cone, and in some cases, after a few hours there is considerable improvement in the vision, but a few more hours having elapsed the aqueous humor is again sufficiently abundant to distend the cone as before, and thus the vision returns to its previously defective state.

Puncture of the cornea, evacuation of the aqueous humor, and pressure, or rather support to the cornea, applied immediately afterwards, and steadily persevered in for several weeks, is a mode of proceeding that has had more than one advocate; but to produce a perfect, lasting, and efficient cushion for keeping up this pressure or support has been found, as before said, a very difficult matter.

It is obvious, that in a case of conical cornea, if a part of the cornea were excised, and the lips of the corneal wound approximated, and this proceeding followed by a favourable agglutination of the parts, that flattening of the cone might be expected; hence this plan has been resorted to, by dividing the cornea, as in the operation for extraction of cataract, and then cutting away a small portion from the loose flap. One patient, after recovering from an operation of this kind, had the apex of the cone inclined downwards, and the *myopia* was somewhat lessened; the lower part of the cornea was divided in the operation, and the practitioner afterwards recommended a like section to be made of the higher part, but the patient did not consent.

Fario, an Italian surgeon, at three different times, cut out three small portions of the cornea, each time leaving a hole through which the aqueous humor gradually drained; the closed lids were held together by sticking-plaster, and the corneal breach was found to fill up in about eight days. The first excision was practised at the upper part of the cornea, the second at the lower, the third at the upper and inner; into the aperture made by excision

at the lower part of the cornea, a prolapsus of the iris took place, but this was remedied by the application of belladonna. Each piece of cornea removed was triangular, the apex being near to the sclerotic margin, and, the sides having been cut with the cataract knife, excision was completed by dividing the base with the scissors; the flattening of the eye and the cure thus effected are reported in a medical journal of Bologna.

Breaking up, dislocation, and extraction of the lens have all been practised in cases of conical cornea, and it might be supposed that, in some instances, the operation of extraction would have two advantages; first, that of flattening the cornea by its section (a possible occurrence), and secondly, the lessening of the refracting power of the eye by taking away that of the lens; these operations for destroying or removing the lens in cases of conical cornea, have sometimes been performed in the cataractous or opaque state of the lenticular system, as well as in its healthy and transparent condition.

It has been supposed that some patients would see better through the outer part or side of the cornea than through the middle of it, and hence a portion of the iris has been removed, so as to form an artificial pupil opposite to some part of the cornea less rounded than its conical prominence, and which did not present irregularities on its surface; this proceeding has been more or less successful with different practitioners.

The thought suggests itself whether, after this operation, in cases where the cone is very prominent, a small opaque disk might not be advantageously placed in front of it. It would be easy to make a dark point upon the middle of a spectacle glass, and then gradually extend this until the annular eclipse of the glass attained its most advantageous degree; after this the light would mainly fall upon the outer and less altered part of the cornea.

In some rare instances, both artificial pupil and removal of the lens have been practised, so as to do away with the refracting power of the lens, and at the same time, to admit light through a less conical and less refracting part of the corneal tunic.

It would, perhaps, be quite fair to say that, in the majority of cases of conical cornea, but little benefit will be derived from internal remedies alone, and perhaps not much from topical applications, if we except the mechanical agents for producing pressure.

It is obvious that, before proceeding to surgical operation, the different forms of optical contrivance should be resorted to, and their various combinations carefully tried when the more simple ones fail to assist vision.

Of surgical operations, puncturing the cornea is the most simple, and least dangerous, and if, when once, or oftener done, it should not succeed, it is probable that the eye may not be damaged by the attempt; the chances of its success seem to be increased by the subsequent and continued application of pressure.

In some cases corotomia offers a prospect of success, and if practised by way of the cornea, it is evident, that to select a part of this tunic, which seems by virtue of its position, form, state of surface, and comparatively healthy aspect, to favour our plan, is a consideration of no small importance.

It is to be feared that in most cases it would be very difficult, by the practice of any incision or excision, to cut away, or to do away with the apex of the cone.

In some rare cases of conical and transparent cornea, of long standing, the lens having become

opaque has been removed, and after this the patient has not required cataract glasses, but has seen better without them; here, operation on the lens is clearly indicated, but any operation on the lenticular system during its healthy state, although practised already with some success, and recommended by high authority, is less established by experience.

There is a work by Tome, of Bonn, on the transplantation of the cornea, which may be consulted by those who are likely to take interest in such a branch of surgery.

The progressing or stationary condition of conical cornea should be carefully considered before we decide upon any plan of treatment to be applied to it; and it is evident that this is more especially requisite in cases where surgical operation is contemplated: otherwise, the success of the attempt might be prevented by the subsequent march of the malady. On the other hand, the importance of meeting the disease by suitable remedies, in its early stages, is not to be overlooked; and this remark is more especially applicable with regard to general or local treatment, intended to arrest the affection in its course.

Two questions of great interest present themselves in connection with the origin of conical cornea: one relating to this peculiar condition as now and then assumed by the eye of the child in the womb; the other relating to its occurrence at the various periods of extra-uterine life; to which a third might be added, for the purpose of noticing, in an especial manner, the fact, that conical cornea most frequently attacks the young under or about the age of puberty, or at that period of life when minor defects in the form and refracting power of the organs of vision are not unfrequently met with.

The eye, in the human embryo, is met with as an opaque and rounded mass, in the earlier periods of existence, when no distinction between sclerotica and cornea can be made; but a line of demarcation, shewing the junction of the two parts, is afterwards produced, and subsequently the transparency of the cornea gradually increases.

In the twelfth week of embryo existence, the prominence of the cornea is relatively greater than at any other period of intra or extra-uterine life; and, after this time, it becomes gradually less, as Bischoff, Gescheidt, Ammon, and Wimmer have observed.

At this period, also, the cornea is thick, and becomes thinner as the epoch of parturition approaches.

It is not difficult to conceive how a disturbance of the nisus formativus, an arrest of development, or whatever else we may call it, may give to the newborn child, and to the subsequent adult, an anatomical condition which properly belongs to an earlier era of being, by introducing, as it were, the embryo type to a stage of existence behind the scene of which it ought to have been left, and presenting that as a morbid condition in the man which, at one time, may have been a natural or normal state, during intra-uterine life. The morphology of the human being is not less interesting than is that of the butterfly; and the march of metamorphosis may go astray in either.

Anatomists have paid great attention to the intra-uterine development of the eye, from the first display of the ocular germ to the removal of the pupillary membrane; but, relatively, a less amount of attention would seem to have been given to its progressive growth, in the earlier periods of extra-uterine life—from that primary condition in which this organ is vacant, undirected, and feeble, to an after state

of brilliancy and perfection—to describe which has exhausted the efforts alike of physiologists and poets.

The twelfth week has been mentioned as an interesting period in the intra-uterine development of the eye; and the twelfth year, or an age not far from this, now and then invites attention to important changes in the advancing eye of the child. About this period, and from it onwards to the age of sixteen, that excess of prominence in the cornea is most frequently observed, which, in ordinary cases, requires for its relief the employment of double concave glasses; and the further progress of which might lead on to conical cornea, the treatment of which must be regulated by the form of the cone and by the complications with which it may be associated.

In the form and thickness of the cornea, in the earlier period of life, we find anatomical conditions of great interest, in connection with the gradual occurrence of conicity of the cornea, as well as with the curative process adopted by nature in the gradual removal of opacity of the same structure; for it is not difficult to understand how, in a case where the thick cornea of a child has become opaque, after inflammatory action, the subsequent and gradual

thinning of the cornea may help the removal of the white material from its structure; and a little further, or a little too far progress, of the same action may thin the cornea in such a way as to favour the occurrence of the conical shape of this part; for, although it would not seem that the cornea is morbidly thin in all cases where it is conical, it is not unreasonable to believe that such a condition may sometimes exist; and, what is more, it has, in a few instances, been discovered in autopsies carefully made.

If conical cornea be met with as an error of development of the eye, it is obvious that cases of it, viewed in connection with their source, must be more or less of the same nature, whether they occur before or after birth, while those cases of this malady which present themselves as direct or indirect consequences of inflammatory action, or of any ordinary form of ocular disease, must be regarded as belonging to another variety. It is evident that this distinction may have its use in a therapeutic as well as in a pathological point of view; and hence the importance of not considering our diagnosis of this complaint as satisfactorily completed before the phenomena of the malady have been sufficiently

analysed to enable us to approach a solution of the question here alluded to.

It is easily understood that opportunities for making post mortem examinations of cases of conical cornea must have been very rare; a few nevertheless have been made, and hence important information has been derived, relating not only to the condition of the cornea itself, but also to that of other parts of the eye, as well as to the optic nerves, their commissure, the optic thalami, the cerebral mass, and the cranium; but anatomists seem to have neglected in some measure the conditions of the orbit, of the motor and sentient nerves within it, as well as that of the ocular muscles; for, with regard to the eye and the contents of the orbit, it would be quite true, in the language of Cicero, to say, that all the parts which enter into the composition of the organ of vision, —

"Habent quoddam commune vinculum, et quasi cognitione quadam inter se continentur,"—

hence the importance of determining the precise condition of all the parts when any morbid state, which has been more especially recognised in one, has been found to disturb the harmony and actions of the whole.

With regard to the thickness of the cornea in the conical part, some writers have reported it to be increased, others have seen it diminished, and in one instance, recently published, the thickness of the cornea was found equal, and unaltered throughout; hence it is evident, that in this respect, cases may vary, and it is not improbable, that interesting points of difference may be established by future observation.

Those irregularities on the anterior surface of the cornea, which have been spoken of as distinct facettes on its curve, reminding us of conditions observed in the eyes of some insects, and which have been thought to act like the planes of a multiplying glass, giving a plurality of images, have been noticed only in the living cornea.

It is said, that in some cases, alteration in the position of the pupil takes place,—this aperture passing nearer to one part or other of the greater margin of the iris, travelling, as it were, in that direction in which it may be best supplied with light.

This observation has been made during life; but, if such a change should, or could occur before death, it is easily understood that a soft and yielding film like the iris, having lost its tonicity or contractile power, while yet steeped in surrounding fluid, would not lend itself very easily, in post mortem examination, after the changes which evaporation and exosmose may have produced, to the accurate determination of that which was its previous position and form.

Any observer, fortunate enough to meet with a case in which conical cornea and eccentric or displaced pupil co-exist during life, would do well to determine, if possible, the time when, and the order in which, these two morbid phenomena presented themselves; for, in such a case, the question naturally arises,—Did the two come together, did one precede the other, and if so, which was the first?

Disturbance in the nervous system, more especially in the system of the sympathetic, might derange the actions of the iris, through the medium of the ciliary nerves; and hence we can, without difficulty, imagine an alteration in the position, form, or size of the pupil; and it is quite as easy to

understand that the same source of ocular disease might also affect the membrane of the aqueous humor, or the quantity of fluid which it surrounds; and if, in this way, the aqueous humor should become increased, alteration in the form of the cornea might follow, to say nothing about the nutrition of the cornea itself; for even this might partake of the evil influences in question, which, although easily concatenated with the pen, cannot so readily be displayed with the scalpel. The main purpose of the remark is nevertheless attained, if it be understood that a displaced pupil, if discovered in a case of conical cornea, is not of necessity a consequence of the previously existing conicity of the cornea, but that it may have been coeval with such conicity, or may even have preceded it.

In some of the congenital cases of conical cornea, abnormal forms of the head have been also observed, amongst which the conical or sugar-loaf cranium, spitz-kopf of the German pathologists, seems to have been the most frequent; but the antero-posterior, as well as the upward elongation of the head, has been met with, as an associated morbid condition.

In Cooper's Surgical Dictionary, we find that

"Burgman saw a remarkable case, where the cornea of both the eyes of a person who had been hanged, were so prodigiously extended, that they reached down to the mouth, like two horns." For the spread of this case, the profession is indebted to the "Disputationes" of Haller; and it has been quoted by different authors in connection with alterations in the form of the cornea, some of whom have omitted to mention that it properly belongs to the poetry of the subject.

As conical cornea, and conical cranium, have been found in some instances to co-exist, it is perhaps worthy of remark, that comparative anatomy might be tasked to accumulate facts relating to the relative forms of cranium and cornea, 'mid the varying series of the animal kingdom.

It is not improbable that some cases of conical cornea, which first attract attention in early life, may have existed for some time unobserved; this is likely to happen more especially in the children of the poor, or in those whose imperfect vision is but little known, partly from the fact of their eyes being less exercised on minute objects connected with educational processes, than are those of children in the higher classes, where, in reading, writing, or drawing, defective sight is more readily discovered; and it seems very possible, that hereafter the repeated and accurate observation of conical cornea may tend to shew that it is more frequently a congenital disease than has hitherto been supposed; but in making this observation we must not lose sight of the general truth, that the cornea is often more convex in the earlier than it is in the later periods of life, and that it is prone to assume its greatest degree of convexity as the age of puberty approaches; so that young people often

complain of short-sightedness at this period of life, who knew nothing of it before, and hence we can easily imagine, that one additional step of development might be sufficient for the production of the conical form in the cornea; and thus a case which would only have been one of ordinary myopia easily remedied, had the forwarding of the cornea stopped a little sooner, by its further progress becomes one of indistinct vision from conically prominent cornea, requiring various appliances of art, and sometimes admitting of but very imperfect relief.

In estimating the convexity of the cornea in very early life, along with its refracting power, the greater rotundity of the lens, and its proximity to the iris, at this period, are not to be forgotten.

It is a well known fact that congenital diseases of the lenticular system, now and then affect several children born of the same parents, and not unfrequently, several members of the same stock in successive generations; and it is not improbable that further observation will shew that a corresponding truth prevails with regard to congenital malformations of the cornea, or of the cornea and

other parts at the same time. Ammon, in his Zeitschrift, has a case in point, where several sisters were alike born with conical cranium, and conical cornea; it is not however said that their progenitors suffered in a similar manner.

The previous remark may, in some measure, be illustrated by the following observation:—

In the summer of 1852, two patients applied at the Eye and Ear Institution, Rose Hill, at the same time; the one, a woman, of forty-four years of age; the other, her daughter, a young girl of twelve; both were myopic in an extreme degree. The mother stated that she had been troubled with extreme shortness of sight ever since the age of five years, and that her daughter was equally the subject of this defect of vision at the same early period of life.

In both the iris was grey, and the pupil of normal character; the corneæ were prominent, but not conical, and whether or no there was any peculiarity, or extreme rotundity of the lens, could not of course be satisfactorily determined; but the same bi-concave glasses enabled both patients to see well.

Nevertheless, we occasionally find that conical cornea is acquired after birth, and that in various

ways; sometimes in connection with depraved health, or disturbances of the general system; at others, in connection with ocular complaints, or with conditions that tell especially on the eyes.

The following cases of alteration in the form of the eye, of conical cornea, and other morbid conditions connected with it, may serve to illustrate some of the previous statements:—

A young lady engaged as a governess, twenty-five years of age, not complaining of any special malady, but enjoying what might be called but feeble health, was attacked by small-pox, from which in a few weeks she completely recovered; there was no pitting of importance on the face, but the aspect of the countenance was nevertheless very much changed by the altered condition of the visual apparatus; the eyes upon the whole looked goggling and prominent, and the convexity of the cornea was remarkable, and there was extreme myopia. In vain the patient waited for a gradual alteration in these morbid conditions; the new state of the eye continued, but the myopia was relieved by the use of concave glasses.

There was no remarkable affection of the eyes

during the progress of the eruption; nothing to suggest the thought that any deposit was taking place within or behind the eye-ball, nor any thinning of the ocular tunics; the cornea and humors retained their transparency, the iris was active, the pupil natural, and the retina had its normal sensibility.

Rowley has related the case of a lady, who, after the effects of a severe parturition, became affected by conical cornea in an extreme degree; the front of the eye acquired a sugar-loaf shape, and the defect of vision was not removed by any glasses that could be met with.

In the following notice of a case of conical cornea, in addition to the ordinary history of the matter, we have an outline of some interesting peculiarities, which characterised the patient during life, while the details of the autopsy relating to the brain, as well as to the eye, are such as might be expected from the pen of Ammon; suggesting, as they do, the importance of attending in these cases, not only to the condition of the cornea, but also to that of the other parts of the eye, as well as to the state of the nervous centres, the cranial and facial bones and cavities.

"Mr. B., a native of Switzerland, residing in Dresden, 40 years of age, of nervous temperament, with conical cranium, suffered from myopia in an extreme degree, so that when he wished to see objects at all distinctly, he was compelled to hold them almost in contact with the eye, but always a little to one side; he never spoke of his short-sightedness, and invariably avoided any conversation at all likely to lead to a notice of it.

"For many years (says the German Oculist) I saw him daily, and observed an opalescent appearance in the eyes, especially when they were quickly moved; this frequent observation also convinced me that both the corneæ were conical. In 1846, Mr. B. died of typhus, and after his death, through the kindness of Dr. Hedenus, I was enabled to make a careful examination of the head and eyes.

"The diameters of the eyes were greater than usual; in form the visual organ somewhat resembled that of the fœtus, and both corneæ were very conical.

"The ocular muscles were attached to the sclerotica, farther back, or farther distant from the cornea, than usual, and this was the more remarkable from the great advance of the front of the eye, which was helped forward by the prominence of the cornea. The left sclerotic being divided, it was found to be very thin, and less resisting than natural.

"The crystalline capsule had its normal form and transparency; its two portions, at their approximated borders, were united less closely than usual, and the connection with the ciliary processes was less regular than is generally seen; viewed with a lens, the capsule had not a polished, but a serrated appearance.

"The fibres of the musculus orbiculus capsulociliaris, had received but a feeble development. The liquor Morgagni was abundant, and of normal character. The peristoma Doellingeri was fully developed; the pigment of the uvea, of a deep black colour, was removed, as if it had been a distinct membrane. On the posterior aspect of the uvea, a great number of nerves, entering its parenchyma, could be seen coming from the ciliary processes. The choroid was of a chocolate colour The circle of the ciliary processes seemed to have undergone a slight displacement. The corona ciliaris appeared to be a little retracted, without pigment, and as if withered. The retina was very

thin, and marked by a great number of folds; there was no central foramen, on either side; but the yellow spot was largely developed. The ciliary ligament was very thick, and very broad. The anterior surface of the iris was marked by elevations and furrows, such as are seldom seen; and, along with the thick ciliary ligament, which was as broad as the iris, produced a very remarkable appearance. There was nothing peculiar on the anterior surface of the cornea. A vertical section was made of the right cornea, which was found to be regularly solid, and not thicker near to the sclerotic margin than at the apex of the cone. Both the cornea and sclerotic were thinner than usual. Before the right cornea was divided, its conicity was very great, almost pyramidal. This form vanished as soon as a section of it was made; but even now, the preparation, kept in alcohol, shews that the cornea is every where of equal thickness. In both eyes the membrane of Descemet was plicated vertically, as well as transversely; the folds very much resembling those so readily assumed by the isolated crystalline capsule. The substance of the brain was normal, but its form, like that of the head, was not. The brain was very like to one previously met with, in which the optic thalami were diseased, and along with which the patient had suffered from deformity of the head, amaurosis, and congenital conical corneæ. A notice of this brain, with a representation of its base, has been published in the "Klinische Darstellungen" of Ammon.

"The optical portion of the brain was very much developed. In front of the commissure, the optic nerves were very broad; traced from the eye, they met in the commissure, at a very obtuse angle; behind the chiasma, the nerves were found beneath the large thalami, imbedded in a thick mass of cerebral substance."

In the preceding case, although the anatomical or objective characteristics are given, the physiological or subjective phenomena are in great measure wanting. In the following case, extracted from the "Zeitschrift" of Ammon, the two groups of phenomena, to a limited extent, are placed side by side; and the case has some features of peculiar interest, amongst which is the co-existence of conical cornea and conical cranium, along with an opalescence in

the depth of the eye, resembling more or less that observed in the case last related.

A young man, twenty-one years of age, had conical cornea; the affection was supposed to have been congenital; the patient had also a small and conical cranium. At sixteen years of age he began to learn the business of a tailor, but was compelled to relinquish it, after five years, on account of extreme short-sightedness; the right eye was the worst of the two, with it distant objects were not seen at all, near ones with difficulty; double vision, or something more, was complained of—two things for one, three for two, and five for three were seen. The cornea presented no opacity, but in the depth of the eye, an opalescent appearance, more especially in sideway view, was observed; this appearance, however, was less marked in the left eye, which had less of conicity.

Seiler, in his valuable work, entitled, "Beobachtungen urspruenglicher Bildungsfehler und gaenzlichen Mangels der Augen," published at Dresden, in 1833, gives the observations made by Professor Jaeger, of Würzburg, on the post mortem examination of a case of conical cornea, in which both eyes were affected; this account, which for some time was the

only pathological record of the kind, has many points of great interest, connected, not only with the important minutiæ of its morbid anatomy, but also with the previous blindness of the patient, and the failure of art in attempting to afford him relief; it may be reproduced as follows:

"The right eve and the optic nerve entering it were in normal condition; the cornea was driven forward by slight pressure. The anterior part of the sclerotic and the cornea were separated from the choroid. There was no cicatrix found on the inner surface of the cornea; the membrane of Decemet was not thickened, and as usual could be separated in small transparent flocculi. The cornea, when held between the fingers, was found to have a depression in the middle, and this was surrounded by a well marked and elevated margin; a section of the cornea being made, its middle third was found to be not more than one third the natural thickness, or about that of fine writing paper, while the two other, or the outer thirds, were much thickened; and this thickening had taken place not in the outer, nor in the inner, but in the middle lamella, the substance of which was homogeneous. The thickening of the

outer ring of the cornea was gradually lost in its thinned central part, the latter, in size, corresponding to a moderately dilated pupil. The choroid, the yellow spot, and the ciliary nerves were in normal condition; the retina was firm, presenting on its outer surface several dark brown spots, produced, apparently, by adhering portions of pigment, while on the inner aspect of the somewhat thickened choroid, dark spots were also observed, which did not seem to belong to the normal condition of this surface. The lens was healthy; the vitreous humour not perfectly transparent, the streaks seen during life not observable, and the fossa in its anterior part undefined.

2. "The left eye had been punctured with a view to curative effect. In it, the following anatomical observations were made:—The upper part of the membrane of Decemet, and the inner lamella of the cornea, were closely connected with the border of the iris, and with the ciliary ligament; in its outer part the cornea had more than its natural thickness; at its central part, not more than half its natural thickness; the pupil was nearly closed; the uvea at the pupillary margin adhering to the capsule of the lens; the choroid and yellow spot normal; as in the right eye,

the retina was firm, with brown spots on its exterior; the vitreous humor perfectly transparent; the aqueous humor was not more abundant than natural in either eye; the lens was milk-white, with chalky-looking points in it; it was also small and soft, so that some portion of it seemed to be lost. Recollecting the conditions which prevailed during life, the following observations seem to be important:

"The patient was 39 years old, of middle size, and strong body, blind from his youth: he was not aware of ever having suffered from inflammation of the eyes, but from the age of 6 to that of 11 years, he was much troubled by an eruption on the scalp; the head square, broad, and of strong bony formation; the forehead small, the right tuber frontalis and arcus superciliaris stronger than the left; the eyebrows strongly marked; the eyes deeply situated in the large orbits, the fat within the latter being in small quantity; the eye-lashes, especially the upper, unusually long. Upon the whole, the eye-balls have their normal structure and consistence. The right cornea is evenly distended, and forms nearly a hemisphere; the most prominent part of it being, not at the middle, but a little below this point.

Passing from above downwards, a slight and irregular opacity is observed; the outer parts of the cornea are perfectly transparent; the brown iris is somewhat concave on its anterior aspect. The pupil is not perfectly black, but has somewhat of a smoky appearance; and after the widening of it the partially darkened fossa of the vitreous humor is seen through the lens; this fossa has an emerald green appearance, with whitish and shining striæ passing from without inwards, as well as upwards and downwards. The cornea of the left eye has greater conicity; the convexity is tolerably regular, from the outer towards the middle part of the tunic, the highest point of it being placed a little above the middle of the cornea; a little below the middle there is an opacity stronger than that observed in the opposite eye. The sclerotic, iris, and pupil resemble those of the other eye; the deep-seated striæ are not observed; the eyes are unsteady in their motions, resembling what we meet with in cases of congenital cataract. In March, 1830, Professor Jaeger punctured the cornea in the middle, with Beer's cataract needle, but without the least benefit to vision. In July of the same year, the patient died of consumption, having previously suffered from pneumonia and asthmatic attacks."

In this case the blindness of the patient was so complete, that he had never seen sun, moon, or colour, and had no idea of the aspect of things around him. In his tenth year he received a blow on the sacrum, which was followed by epilepsy, the attacks of which used to return once in eight or ten weeks; on this account he was occasionally bled from the arm, and was in some measure relieved by the venesection.

It is especially worthy of remark, that the patient had previously lost a brother and a sister, both born before himself, who were also blind from their infancy; the precise nature of their blindness is not known; they were probably amaurotic; but whether or no, they also had conical cornea; or whether at the same time any abnormal form of the cranium prevailed, we need not attempt to surmise.

The three following cases are reported by Dr. Wimmer, in the second volume of Ammon's Ophthalmic Journal: Dresden, 1832.

In the first case the ocular disease affected one

eye only, and was probably the consequence of infantile ophthalmia, and was not accompanied by any peculiarity in the form of the head; in the second and third cases the disease was congenital, accompanied by amaurosis, also congenital, and associated likewise with flattened forehead, and more or less conical or elevated cranium; in the first case the patient had good vision with one sound eye, in the other two blindness prevailed.

"John Frederick Hartmann, a boy, 13 years old, from Köpenick, near Berlin, has now been six years in the Waldheimer Orphan Institution, and from infancy has suffered from malformation of the right cornea; along with this he had formerly feeble vision in the eye affected, but this eye is now totally blind.

"I saw this boy (says the German Author,) on the 4th May, 1832; his appearance was healthy, his constitution moderately strong, and in his aspect there was no marked characteristic of scrofula. The cornea of the right eye was very prominent, reaching beyond the margins of the eyelids. It appeared to have attained a projection about three lines greater than natural, the most prominent point cor-

responding to the middle of the cornea. As is often the case in hyperceratosis, the cornea had a crystalline and opalescent appearance, especially in side-way view. The upper and outer part of the cornea presented a streak of opacity of about a line in breadth, but the central part was perfectly transparent. The iris appeared to be pushed a little backwards, and shewed a few red points, as if from the widening of its vessels, similar to what Chelius in one instance observed. The pupil was somewhat widened, and had the natural black appearance. The patient did not complain of any pain in the eye. It would seem that the boy has had this disease from his earliest infancy; and Dr. Neuhof reports, that within the last six years it has not in the slightest degree changed, hence it is probable that it has either been congenital, or that it has followed an attack of ophthalmia neonatorum. Whether or no myopia prevailed previous to the extinction of sight, could not be ascertained. The left eye is perfectly sound."

It is worthy of remark, that, in this case, the conical cornea is reported as being perfectly transparent at the centre, although this centre had for some years projected beyond the margin of the eye-lids; such transparency could scarcely have been preserved unless the patient had enjoyed the power of completely closing the eye, or of sleeping with the globe perfectly covered; hence it is probable that although the apex of the cone might seem to be in advance of the tarsal margins, that these, in waking hours, were enabled to protect the organ by their approximation in winking motions, as well as to shield it by their continued closure during sleep.

"Charles Traugott Klosse, 11 years old, from Friedrichswalde, near Pirna, (in the Blind School of Dresden,) was born blind, and has a scrofulous appearance, and in his fourth or fifth year suffered from chronic ophthalmia, probably of a scrofulous character. With the exception of a peculiar form of the head, his bodily conformation is good. The forehead is flattened, and the parietal and occipital bones, as it were, pushed upwards and backwards in an unusual degree; the parietal protuberances being at the same time much elevated.

"In both eyes the cornea has the peculiar form and aspect which characterise hyperceratosis,

advanced but to a limited degree, the forward bulging or conical prominence of the cornea not having more than one line of abnormal advance, but the glancing brilliancy of the cones is very remarkable. There is but little mobility in the pupils, which are placed towards the lower and inner part of the iris, the rim of which is narrow here, and considerably broader at the upper and outer aspect. On the nasal side the iris has changed its natural blue for a brownish-yellow colour; this being probably a result of former inflammation. The iris and cornea are remarkably large in both eyes; the latter, as well as the conjunctiva, being in a state of irritation. There is no other case of ocular disease in the family of the patient."

"Augusta Schurig, 11 years old, from Rode, near Grossenhayn, of rather weak constitution, but otherwise healthy, and free from any appearance of scrofula, was born amaurotic: she is very quick, and intelligent, and says that she never suffered from any inflammation of the eyes, which is corroborated by the corresponding statement of her parents. In form, her head nearly resembles that

of Klosse, the forehead being flattened, the parietal regions carried upwards and backwards.

"The prominence of the cornea is considerable, not less than a line too much on each side, and this is accompanied by that sparkling brilliancy which is rarely wanting in cases of hyperceratosis. There is but little mobility in the pupils, which are carried somewhat to the inner or nasal side, that of the left eye being also lower than natural. In this little girl, the blue colour of the iris, at its inner part, is changed for a brownish yellow. (May this have been a result of inflammation?) The eyes are deeply placed in the orbits, but in addition to the above noticed morbid conditions betray no abnormal characteristics.

"This patient has a younger sister, 18 months old, suffering, as it would seem, from the account of the parents, from amaurosis, and conical cornea; conditions which followed an attack of ophthalmia neonatorum; four other sisters, as well as the parents, are in perfect health, and without any ocular complaint."

In the following case, reported by Dr. Heyfelder, in the fourth volume of Ammon's Journal, we find

a notice of peculiarity in the form of the head, (flattened forehead,) along with conical cornea, which may have been congenital, although this condition of the cornea could only be traced back to very early infancy. Temporary improvement of vision was afforded by dilatation of the pupil, and it is perhaps not improbable that cylindric lenses might have been tried with some prospect of further success.

"In a man from the neighbourhood of Mengen, in the Grand Duchy of Baden, 32 years of age, of scrofulous constitution, and with forehead remarkably flat, the cornea presented that remarkable prominence to which, by some ophthalmologists, the name Hyperceratosis has been applied; while, by others, the more suitable appellation of Conical Cornea has been given to it; a third class having preferred to designate it Staphyloma Conicum.

"In the right eye the cornea had a sort of sugarloaf shape, the centre of the pyramid corresponding to that of the cornea and pupil; in the left eye the cornea was less prominent, and, as to form, might more conveniently be compared to a molehill; the central part being the highest point, as in the cornea of the opposite side. On both sides the cornea was perfectly transparent, while the greyblue iris at its outer margin seemed to be pushed towards the base of the corneal pyramid, and at several points to be so closely connected with it that the name Staphyloma Conicum might easily have arisen from such anatomical conditions and relations. Light acted but slightly on the pupil, this aperture was nevertheless freely dilated by the application of hyoscyamus; otherwise partial adhesions of the iris would have been suspected. Viewed in front, both eyes looked as if opacities existed opposite the pupils; these were better seen when the globe of the eye was moved by the finger in the approximated state of the lids. Viewed sideways, the conical cornea had a sparkling, and, at the same time, an opalescent appearance. In the left eye the sight was not quite so bad as in the right; nevertheless, at the distance of even six feet the patient was unable to distinguish objects. To see any thing distinctly, he placed it sideways, or immediately under his nose, and vision thus exercised was improved after the employment of the hyoscyamus drops.

"This ocular complaint had prevailed since the earliest period of life. From his mother's account it would seem that he was not born with it, for she declares that it was produced by a violent fit of coughing, which occurred during the time that he suffered extremely from hooping cough, in his second year; how far this is correct we need not attempt to determine; but it seems not unreasonable to suppose that conical cornea might be produced during the violent agitation of the system accompanying a fit of hooping cough, as well as by those efforts, strains, or screams, which are associated with uterine actions in the progress of parturition, and which are regarded by some as capable of giving rise to hyperceratosis.

"From the long standing of the malady, complete cure seemed out of the question; so that the patient was merely advised to use the drops of hyoscyamus, with a view to the occasional dilatation of the pupil, by the aid of which it was found that, in his case, objects were a little better distinguished.

"The anatomical examination of such a case of conical cornea would be very interesting, for the

purpose of discovering whether, and how far, the lamellæ of the cornea are affected; and also for determining whether any morbid condition of the aqueous humour, or the want of this fluid, had acted as a cause of the malady. In the case here related, if the appearances were not deceptive, the aqueous humour existed, but in very small quantity."

In cases of conical cornea, it must generally be very difficult, during life, to form any accurate idea of the amount of aqueous humor which the eye may contain; for it is not unreasonable to suppose that if the cornea were thin, as well as conical, that the amount of aqueous humor might occasionally be found greater than natural; while, on the other hand, a cornea thickened, as well as conical, might in some degree encroach on the space which, in the normal state, the aqueous humor would occupy. In post mortem examinations of cases of conical cornea, this tunic has sometimes been found unaltered as to thickness, at others thicker than natural; in some instances, thin at one part and thick at another; but the most frequently observed condition seems to be that in which the cornea is found thin in the central part,

or in that corresponding to the prominence of the cone, a state more likely to be associated with increase than with diminution of the quantity of the aqueous humor; in connection with which it is not unworthy of remark, that cases occasionally present themselves where the practitioner requires to pause before he allows his diagnosis to be completed, with the expression, conical cornea, on the one hand, or with that of hydrops oculi, on the other.

In the cases of conical cornea which have come under my notice, in man, as well as in some of the lower vertebrata, the aspect of the eye has favoured the idea that the cornea was thinner, and the quantity of the aqueous humor greater than natural; but the clear, crystalline, and dazzling look of the eye has rendered it impossible to say positively at what point, in the direction backwards, the cornea might end, or where the aqueous humor might begin.

This observation is quite true with regard to the following case of conical cornea, where the cornea *seemed* to be thin anteriorly, or in the most prominent part, as well as fully distended, by perfectly clear aqueous humor, but, as elsewhere observed, the thickness of the affected tunic could not be determined in any perfectly satisfactory manner.

S. H., æt. 31, a tall and thin young woman, from the vicinity of Manchester, consulted me on account of an affection of both eyes, in September, 1852.

It was evident, even at first sight, that she suffered from conical corneæ, the sparkling aspect of the eyes betraying this at once to ordinary observation.

She commenced the account of her sufferings by saying that she had constantly "a worm" before her eyes, or an appearance, as if a large worm were nearly always moving or floating in a slanting direction before her view, and that this appearance was seen with both eyes, and also with the right, or with the left eye alone, but most of all when the left eye only was employed.

Her next remarkable statement was that her vision was very imperfect, and as it were deceptive, and hence it happened that she often made mistakes as to her position with regard to things around her; now and then, for instance, supposing herself

to be at the bottom of a flight of stairs, when, in reality, she was some steps above the neighbouring floor; and in this way, from time to time, she fell so as to injure herself severely.

She is a young woman of moderately strong constitution; in earlier life her health was good, the catamenia having commenced at the age of 15.

At the age of 19, a scrofulous affection manifested itself on the neck and neighbouring parts, where, from this age to that of 23, open scrofulous sores existed, the cicatrised remains of which are seen at present over the whole length of the right sterno-mastoid muscle, in the lower part of the neck immediately above the sternum, as well as beneath the left ear.

At the age of 20 she received a severe blow on the top of her head, from a piece of iron against which she struck in mounting a stair, and to this injury the ocular complaint was attributed; for, about two months after the blow, she began to suffer from severe pain across the forehead and immediately above the eye-brows, with such sense of weight that the head was frequently held down and supported on the palms of her hands.

In about three months after the commencement of the suffering in the head, the patient found that her eyes were dim; she was now blistered on the temples and at the back of the neck, after which the head-ache was lessened, but the dimness of sight remained. The orbits are large, so that anteriorly the eyes are far from seeming to fill them; hence there is a considerable space between the round of the upper lid, where it rests on the somewhat prominent eye-ball, and the arched border of the orbit above; an aspect in some measure reminding us of the appearance not unfrequently presented by people with large facial bones, and who have suffered from long-continued disease, which has thinned the tissue or reduced the plumpness of the soft parts. There are no marked vestiges of ophthalmia in either eye.

A taper being held before either eye, its images are distinctly seen; but appear very small when the flame is opposite to the most conical part of the cornea.

The "phosphenes" are somewhat brighter in the right than in the left eye.

The conicity of the cornea, as before remarked, was inferred from the glancing or sparkling brilliancy of the eyes, and on both sides the advance of the cone was readily seen in lateral view of the organ; while, by more careful observation, it was found that the most prominent part of each cornea was a little to the left of its middle point; in the left eye opposite to the outside, in the right eye opposite to the inside, of a moderately widened pupil, each prominence being at the same time a little lower than the centre of its respective or corresponding pupil. The appearances just noticed were observed with the naked eye, with convex, and also with concave lenses; but the apparent or varying magnitudes were found to have the correspondence which was expected.

The perfect clearness and lucidity of parts observed in front of the iris, was not marred by any opacity, nebulosity, trace of cicatrix, or vestige of any previously existing morbid action, which the naked eye could detect; on the anterior surface of the cornea perfect smoothness prevailed, and it is probable, at least, that a surface equally smooth existed behind.

It is the more important in cases of conical cornea to attend to these details, as closely as possible, inasmuch as some authors have supposed that, in all instances of conical cornea, ulceration has previously existed, a generalization which would seem to have been based on particulars not sufficiently numerous.

The only alteration of the cornea about which we could be perfectly satisfied was that of form, (in the most prominent part it was perhaps thinner than natural,) but this could not be determined in a manner which would meet the demands of morbid anatomy; the observation is equally true of both sides. The iris had its natural position, and betrayed no mark of disease, and the pupillary motions were good; and although more or less of myopia prevailed, the action and aperture of the eyelids had not undergone any alteration worthy of pathological record.

The function of the retina, as exercised in this case under the altered conditions of the refracting apparatus of the eye, is worthy of the greatest attention, the main difficulty which the patient

experienced being associated with the altered focus of the visual rays, and the accompanying impossibility of seeing any distant object clearly; hence at times dangerous mistakes respecting the position of things around her.

Near objects were better seen; with both eyes she read a few verses of a Bible in the small pica type, at the distance of two inches; at that of three inches she read the same with the right eye alone, but with the left eye alone she could not distinguish the letters; at the same time that she held the book with position and inclination which favoured the function of the right or better eye.

Before closing the observations which relate to the retina, the phenomenon of the worm, if so it may be styled, will require a passing notice; here two questions suggest themselves, the first, What was it? the second, Whence was it?

With regard to the former we may remark, that there is reason to think that it was mainly a retinal, rather than a corneal phenomenon, belonging to the class of muscæ, with forms as various as the Proteus of antiquity, but perhaps somewhat better understood.

In this case the appearance of the so-called worm did not precede, but followed the occurrence of the conical cornea; but we must bear in mind that marked head symptoms, with pains in the neighbourhood of the orbits, apparently betraying something of general disturbance in the eye, if not in the head as well, were forerunners of the corneal affection; hence it is possible that a morbid condition of the retina, as well as of the cornea, may have prevailed at an early period in the history of the disease, and that the muscæ, now so much complained of, may be a vestige of former disturbance of the deeper parts of the eye; but whether in this view the retina should be alone noticed, or whether at the same time the vitreous humor or other part should be associated with it, as capable by any morbid condition of giving rise to the annoying phenomenon, we need not attempt to surmise.

It is very probable that in any case where muscæ volitantes, arising from morbid condition of parts at the back of the eye, are associated with remarkable alterations of form in the refracting apparatus in front, that the trouble they will give rise to, as well as the morbid state of the retina or other part on which they depend, will not be lessened, but rather increased, by abnormal refractions produced in the transparent media of the visual apparatus; to which observation we may add, that although it is not probable that the altered form of the cornea is the cause, in this instance, of the muscæ we now attend to, instances may occur where a cornea, altered in form, or in surface, may present mechanical conditions that favour the resting upon some parts of its exterior of tears, mucus, or bubbles of air, separately or in combination, and in this way may give rise to modified appearances of muscæ, which would be spoken of as being of anterior or corneal origin.

One of the most interesting considerations belonging to this case is that which relates to its primary phenomena, and to the constitutional conditions or circumstances associated with its beginning.

It is important to bear in mind that the patient and her friends attributed the ocular complaint to an accidental blow on the top of the head; but we must recollect, at the same time, that for some months previous to this injury she had suffered from strongly marked scrofulous disease; and as conical cornea has been repeatedly observed in connection with the scrofulous condition, its occurrence in this instance would not have been regarded as any thing very extraordinary, even if the blow had not been met with; at the same time we must not rob the blow of its possible importance, inasmuch as the supposition is not unreasonable, that a pre-disposition to ocular disturbance, already existing, or such disturbance, in any measure, having already commenced, might be, in some degree, roused, or helped on, by the external injury, now regarded as an exciting cause.

There was nothing in hereditary or family associations, nor in the mode of life, or occupations of the patient, which requires to be noticed in connection with the occurrence of conical cornea; while, in negative information, two observations are important—first, that the disease was not congenital; and, second, that it did not occur at that early period of life, say from twelve to sixteen years of age, at which, relatively, it often happens; hence the apparently greater importance of the constitutional

conditions and morbid phenomena that prevailed at the time of its origin.

In this case, it did not appear that any medical or surgical treatment, general, local, or operative, would be likely to exert any beneficial influence on the state of the corneæ; and inasmuch as it seemed probable that the fault of refraction could be in some measure corrected by optical contrivance, recourse to this was evidently indicated; the artificial iris, the ordinary concave lens, and the concave cylindric lens, were in turns tried; when it was found, that all were beneficial, but in very different degrees; the concave cylindric lens being the instrument which afforded efficient and surprising relief; for, with it, the patient could at once read, at an ordinary and comfortable reading distance, the book which the moment before was brought close to the face when she attempted to read with the naked eye.

In adapting optical instruments to cases of this kind, it is absolutely necessary to be provided with full sets of lenses, or other apparatus that may be required, otherwise the surgeon, or the optician, may easily miss his aim; as, in these matters, trial alone can determine what is wanted, by shewing that which

answers our purpose; and it is found that without the practical application of the artificial iris, and of the lens, or of both, we cannot at once say whether one or the other, or a combination of the two, may in any case answer the best; comparison of results being the only means which enables us to arrive at a satisfactory conclusion in this respect. Several lenses should be tried, that the patient may compare the states of vision produced by the aid of each, and all haste in the trial should be avoided, and confusion from the employment of numerous lenses guarded against, by allowing a short interval of rest to the eyes, between the laying aside of one and the exercise of the sight with another.

At least four different forms of artificial iris should be tried in these cases.

1. The flat disc of blackened metal, with a pupillary opening in the middle; when a couple of such discs are mounted in spectacle frames, the apertures in their centre should be capable of approximation, or of separation, by the employment of sliding pieces that carry the opening towards the inner or towards the outer part of the spectacle circle or eye-piece, or by the aid of a joint in the bridge of the instrument, midway between the two eye-pieces.

- 2. The same disc of blackened metal with a transverse slit instead of a central foramen; the discs with the slit should be circular, and so placed in the spectacle frame as to be capable of being easily turned round, so that the slit if requisite may be placed obliquely, instead of transversely; a position more likely to suit the Mongolian than the Caucasian eye, but which nevertheless may now and then be found useful in the latter.
- 3. The small black cup of ebony, or other dark or hard and blackened wood, the concavity to be turned towards the eye, and with a pupillary aperture in the centre; a couple of such pieces being fixed in ordinary spectacle frames.
- 4. The same concavo-convex pieces of wood with eccentric foramina, so that the pupillary aperture in the wood may be towards the inner side, thus favouring the convergence of the two eyes; but at the same time, by turning, admitting of the aperture in either piece being more outwardly directed. Combinations of the artificial iris, with various forms of the ordinary concave, or of the concave cylindric lens, if kept ready for use, would now and then be found to render important service to the surgeon, when he seeks to

determine the kind of optical assistance by which some cases of conical cornea are so remarkably benefitted.

It is evident, that if in cases of this kind the prominence of the cornea could be flattened in but a very small degree, by any mechanical agency that would not injure the surface of the tunic, such flattening might at once lead to improvement of the sight, which would be likely to continue as long as the modification in the form of the cornea could be sustained.

In the case just related a mechanical contrivance was resorted to for the purpose of altering slightly the form of the cornea, and in this way considerable improvement in the vision was immediately produced; but as the instrument employed for producing the effect had been previously contrived for another case, and in it used with success, a notice of its mechanism and supposed modes of action may better be given along with an account of the remarkable case of myopia to which it was first applied; and to the history of which we shall hereafter proceed.

In connection with the conical or prominent state of the cornea, and with myopia, the function and conditions of the eyelids are worthy of particular notice. Every one observes the tendency, in short-sighted people, to close, or approximate the eyelids when near objects are viewed, and this shutting of the lids has supplied the classical name *myopia*, as the designation for the short-sighted condition; a name, which contains no literal allusion to short sight, but points literally to the movements of the eyelids by which nature attempts, in some measure, to lessen or to remedy this morbid state. By these actions of the lids the more disturbing part of the light is excluded, and at the same time it is possible that the position, and even the form, of the eye, may in some small degree be influenced by the backward pressure which the organ feels from the more or less close and firm contraction of the orbicularis muscle.

It may however be observed, that these efforts of the eyelids are not commonly equal to the adequate correction of the defect, which they, as it were, instinctively seek to lessen; hence it has seemed interesting, by observation and experiment, to have found, that by making an artificial addition to this action of the lids, we may, in many cases, completely remove the myopia, and this by a contrivance of a very simple character. If, in a case of extreme myopia, the outer canthus be drawn outwards and backwards, by applying the end of the index finger upon the neighbouring temporal integument, the lids, by such traction, are somewhat approximated, and pressure is exerted on the cornea, when it is not a little surprising to find that the patient will often, all at once, declare that he sees things at a distance with perfect distinctness, of which he had the moment before but an indistinct or confused view, or which he perhaps could not see at all.

This pressure may be kept up without any great inconvenience, and for a considerable time, by a steel spring, with a small round pad, a little larger than a sixpence, at the end of it, the pad, lined with a soft material, being placed upon the temporal integument, which has been previously drawn back in the manner above noticed. A point d'appui is easily given to such a spring, by allowing it to pass downwards and forwards, towards the canthus upon which it has to act, from another spring encircling the fore-part of the head, in shape like a horse shoe, and completed by an elastic band carried round the occiput, so as to form a kind of fixed and steady head-band, upon one point of which, more or less near to the parietal-pro-

minence part of it, the end of the other may be rivetted, so as to permit a little forward or backward motion at the rivet joint.

The subject of the following very interesting case had suffered from corneitis, and, in consequence, had opacity of the left cornea, and alteration in the form of the right cornea without opacity; he was troubled with very short sight, by which he was prevented following his occupation, this being one in connection with which he could not conveniently use spectacles; hence I was induced to attempt the mechanical contrivance just noticed, for the purpose of altering slightly the condition of the eyelids, as well as the position and form of the eye; this proved successful, and by its aid the myopia was removed, and temporary distinct vision obtained.

J. J., aged 19 years, a young and robust sailor, had inflammation of the eyes in early infancy, from which, at this period of life, he was nearly blind during three years; at the age of 14 he had the small-pox, when his eyes again suffered, so that he was blind during six days, but after his complete recovery from the variola, his vision was found not to have been impaired by this attack.

At the age of 15 he went to sea, and during the

first year of his service his sight was equal to any occupation then given to him; but after a while, when he was required to "take the wheel," he found that he could not see the compass by lamp-light, in the night, although in the day time it was visible to him; hence, in the night, he was induced to resort to the expedient of steering by a star, which he selected and kept steadily in view.

For the purpose of testing the state of his sight, as well as with the view of supplying him with some efficient means of relieving his infirmity, a series of lenses were tried, and amongst these it was found that the bi-concave and crossed cylindric glasses were of greater service than others; these enabling him to read a type which he could not see without them.

The following observations relate to the right eye, to aid which, the instrument above alluded to was made.

When the eyelids (but more especially the upper) were drawn somewhat closely upon the eye-ball, so as to make gentle pressure upon it, the upper lid at the same time descending very slightly below the level of the highest part of the pupil, (at this time rather wide,) the vision was at once improved, so that things

which appeared confused, the moment before, were now distinctly seen.

When supplied with this instrument, the patient tried his vision upon different objects, amongst others upon a flower-pot and its contents, viewed across the street; without the spring, he could see the flower-pot in an indistinct manner, but with the aid of the instrument, and the associated retraction of the hids and their pressure upon the eye, he could see clearly not only the flower-pot, but also the plant and flower it contained, and while viewing them spoke with accuracy of their position, size, form, and colour.

Since the trial made with the spring, in the case here related, the vision of other myopic patients has been found to be improved by a similar application, not, however, as far as I have yet seen, in so remarkable a manner, saving in one other instance, where a clergyman, very short-sighted, and always using a glass for viewing the more distant objects around him, was surprised to find the improvement in his vision which was effected by the application of the spring.

As may easily be supposed, the effect requires to be produced with great nicety; too little or too much traction on the integument spoils the attempt; and in more than one instance I have found that a slight inclination upwards of the outwardly drawn canthus has a tendency to improve the result.

It is to be borne in mind that an instrument applied in the way we have noticed may act in more ways than one; that it indirectly causes a slight pressure on the cornea we cannot well doubt; while it may be remarked, that in cases of conical cornea, with thinning of this tunic, a very slight pressure may be capable of effecting considerable alteration of form, which alteration might be of an unfavourable kind, if exerted above and below the apex of the cone, and too near to it; in other words, if it acted upon it in such a manner as to produce additional advance in the most prominent part. One mode of producing the desired effect is to request the patient to close the eyelids with firmness, then, while they are so closed, to put them on the stretch required, and next apply the spring to fix them; the patient may now as it were allow them to open with the least possible effort, when their condition will be such that the amount of light falling on the cornea will be limited by their approximation, while its refraction will be modified by the altered curve of the tunic; and it is perhaps fair to

regard these combined conditions as the source of the improvement in vision, while the least fortunate part of the matter is the fact that the spring must require frequent removal, and hence, as far as convenience is concerned, is not to be compared with spectacles, although it is capable of a longer and continued application than might at first be supposed.

The sympathies of different, and often distant, parts of the body frequently attract the attention of medical practitioners, betraying, at times, the probable localities or modes of origin of disease; at others, suggesting plans of treatment in accordance with the special indications of the case. The sympathies of the digestive tube and organ of vision, are amongst the most interesting of the group here alluded to: alterations in the conditions of the former, are often the immediate forerunners of serious changes in the latter; the dyspeptic, and those who suffer from functional derangements of the stomach and liver, not unfrequently seek relief for disturbances in the eve, even while neglecting the morbid state of the chylopoietic viscera, with regard to which they are less apprehensive. Changes in the condition

of the circulatory system of the digestive tube, are frequently observed to tell remarkably on the eye; sometimes being followed by impaired vision, at others, by complete blindness. The sudden occurrence of hæmorrhage, in an extreme degree, or the suppression of hæmorrhage which has for a long time been periodical, returning, with more or less regular intervals, from some part of the mucous surface of the gastro-intestinal system, or from some neighbouring division of the corresponding membrane of the respiratory apparatus, belong to the occurrences here contemplated. Cases of conical cornea capable of being adduced as illustrations of the above remark are of very rare occurrence; in the following instance, however, the associations alluded to seem to have existed.

A. B., æt. 27, a strong man, of sanguine temperament, was attacked, without any very apparent cause, by iritis, in the left eye; the inflammatory action was severe, with strongly marked redness of the sclerotic vessels, as well as traces of red vessels advancing towards the centre of the transparent cornea; the proper organization of the iris was rendered nearly invisible by the reddish-brown

lymph deposited upon it, the pupil was irregular, contracted, and fixed, and vessels containing red blood were visible upon the iris; while this membrane, with the aspect of considerable tumefaction, looked as if it were pushed forward into the anterior chamber; the photophobia was extreme. Venesection, six or eight times repeated, calomel, mercurial frictions, and the local application of cold, were resorted to, and in about ten days the good effects of the treatment were obvious; immediately after this favourable change, and when the eye could bear a little light, so as to allow the separation of the lids, and the careful observation of the organ, it was observed that the cornea was much distended. and its form already changed by a great accumulation of perfectly clear aqueous humor behind it; this, however, should be regarded as but one part of a general distension of the eye-ball, which at this time prevailed. The outer part, or ring of the cornea, was for some time a little hazy, but the central portion was clear, and in about three weeks after the beginning of the iritis, the commencement of conical cornea was observed, and in the course of ten days the change in the form of the cornea

was so remarkable, that, at the end of this time, a completely conical shape was acquired; the apex of the cone being placed a little below the centre, and slightly towards the inner side; the most prominent part of the cone was evidently thin, and was easily depressed, or bent under a light touch, while the outer circle of the cornea did not appear to have lost any thing of its thickness or strength. At the time now contemplated, the patient had completely recovered from his iritis; the deposit on the iris had been absorbed; the pupil was moderately round and active, but drawn a little towards the outer side; there was no apparent morbid condition of the lenticular system; the retina did not seem to have undergone any serious change, for the sensibility to light was not complained of, but in viewing objects the myopia was extreme; and the cornea presented at the conical part such a remarkable aspect of fullness, that the surgeon proposed the puncture of this tunic, with the view of lessening the distension from which it seemed to suffer; to this operation, however, the patient did not submit. Bi-concave glasses were afterwards resorted to, and with benefit to vision. The right

eye, at this time, was not affected by any corresponding disease, but it had formerly suffered from pannus, and enjoyed but a limited amount of sight.

It seems peculiarly worthy of remark, that this patient had been constantly troubled with hæmorrhoids during more than twelve months, losing frequently a considerable quantity of blood from them; and, on recovering from his iritis, he first related this part of his case, and remarked, that the bleeding from the piles had stopped somewhat suddenly about a week before the iritis came on.

In the two following cases, we have illustrations of disease of the iris, (perhaps rather of the membrane of the aqueous humor) associated with previous disturbance of the cutaneous and fibrous systems.

A man, 24 years of age, suffered from an attack of acute rheumatism, which was accompanied by iritis, and the iritis was followed by conical cornea, displaying the brilliant eye and other characteristics of the disease, without muscæ volitantes, or symptoms of amaurosis; with perfect transparency of the cornea, and with normal condition of the irides; but with extreme myopia.

A man, 30 years of age, had a severe catarrhal affection, which was accompanied by iritis; after which, conical cornea, without opacity, followed, with normal condition of irides, and without amaurotic symptoms, but with extreme myopia.

Attentive observation seems to lead to the conclusion, that internal ophthalmia, occurring in connection with various cachectic conditions, may sometimes affect more especially, the membrane of the aqueous humor, at others, that of the vitreous humor, while in a third class of cases it may interfere more especially with the deep tunics of the eye, telling upon the retina, the membrane of Jacob, or upon the choroid, separately, or in connection; hence, in the first class of cases, we may have aquo-capsulitis, or iritis, as it is oftener called, and occasionally, conical cornea, as a consequence; in the second, synchisis, or, now and then, glaucoma; in the third, choroiditis, or amaurosis; and but too often, various combinations of these morbid conditions.

Of the first class of cases, illustrations have been already given, by virtue of which, conical cornea might, as it were, be traced back through aquo-capsulitis, to the general derangement of the system, in connection with which the ophthalmia occurred; we may next proceed to interesting illustrations of diseased conditions of the vitreous humor, occurring in individuals who laboured under a well-marked cachectic condition of body; of which the following case seems to afford a curious and valuable example.

P. B., aged 53 years, a man of middle stature, who formerly enjoyed both good health and great strength, applied to me on the 4th December, 1852, saying that he was blind; that he could distinguish light and dark perfectly well, but that he was unable to discern the position, form, or outline, of objects. During more than 30 years of his life, or from the age of 17 to that of 52, he had been much addicted to the drinking of ardent spirits; rum was his favourite beverage, and if he make no mistake in his confession, he frequently quaffed more than a pint of this liquor, "raw," before breakfast. Nevertheless, his health was good, and, to use his own expression, the rum "always cleared" his head, while ale, when he drank it, made him stupid.

About ten years ago his right eye suffered from

an attack of inflammation, of the causes of which he does not seem to have any available recollection; and after this ophthalmia the sight of this eye was permanently damaged, but the vision in the left eye being good, the patient was careless respecting the loss sustained in the other. He was destined, however, to be roused from this carelessness, by disease attacking the left eye also, from which he began to suffer about a fortnight before he came under my notice, during which time, it was, that the blindness above mentioned had gradually come on, and that without any accident to the eye, and without the occurrence of any pain, or visible disease, of which the patient or his friends could take cognizance.

The appearance of the patient accorded well with what we understand by the expression "hardworn;" it seemed to betray at once the results of intemperance, and of toil, for in reality he had both worked hard and drank hard; his aspect and movements were those of a man not able to see the objects which surrounded him. On examining the eyes, the following interesting conditions were met with.

Right Eye. - In form, size, and degree of firmness, this eye seemed to be very nearly in the normal condition; but, at first sight even, it was noticed, that the iris betrayed a tremulous movement, such as is not observed in the healthy state of the globe; and this phenomenon seemed to be, in part, at least, accounted for, by the condition of the lens and vitreous humor; the lens was opaque, and hence visible, and was seen floating behind the iris, in the lower part of the posterior chamber, presenting an appearance not unlike what is observed after the dislocation of cataract, in cases where the vitreous mass has been softened down, and hence takes no hold of the lens, which is pushed within it; the oscillations, or trembling, of the iris, as well as the undulations of the lens, seemed, probably, to be connected with a condition of synchisis, or liquefaction, partial, or complete, of the hyaloid body. The opaque lens, spoken of as existing in the posterior chamber, seemed to be rather the capsule of the lens, than the lens itself, for it did not present any thing of the lenticular form, but had that appearance which may be easily supposed to result from the approximation of the anterior and

posterior portions of the opaque lenticular capsule. The pupil was of moderate size, and was not insensible to light; a taper being held before the eye, only one upright image of it was seen; the lenticular images, for reasons already obvious, being wanting.

Left Eye.—The observations relating to the right eye apply equally to the left, saving that which belongs to the opaque and dislocated lenticular apparatus, of which there was no visible trace in the left eye.

In the right eye the lens had been dislocated, and the remains of the displaced body were visible in the opaque and floating structure before noticed; whence the absence of the posterior images of the taper in this eye; but a corresponding absence of these images was also observed in the left eye, although in this organ there was nothing visible which corresponded to the opaque and dislocated lens of the opposite side; whence it seemed probable that the lens in the left eye was also displaced, probably thrown down into the lowest part of the posterior chamber, and being there at rest, and as yet transparent, was not seen from the exterior; to say nothing of the possibility of its being invisible from some other peculiarity of position.

That this was a correct view of the matter, was rendered extremely probable by the fact, that, with the aid of a convex lens, the patient was enabled to see with either eye; and with both, saw so well, that he could perfectly distinguish small objects in a window across the street.

It is also to be borne in mind, that, in the eye where the dislocated lens was not to be seen, that its disappearance after dislocation might possibly be due to its absorption; a process not unlikely to occur to the lenticular apparatus when deprived of its normal and vital connections, and which, in rare instances, does happen to the lens while in situ, and this without the interference of art.

In several cases I have met with, synchisis has been observed in men long addicted to the drinking of ardent spirits; in such instances it commonly affects both eyes, but it not unfrequently happens that the vision of one eye fails long before that of the opposite organ is complained of; and we also find that such patients, in many instances, do not seek surgical aid, until some change has taken place in the lenticular system, on one or both sides, until, in short, cataract, with, or without partial or complete dislocation of the lens, has happened, while it need

scarcely be mentioned, that the prognosis in a case of cataract associated with synchisis, must differ considerably from that which would be given in a case of simple opacity of the lens, occurring without any previous change in the vitreous humor, or other part of the eye-ball.

A previous remark, respecting the spontaneous absorption of the lens, may be illustrated by the following observation, which shews something of the unaided vis medicatrix naturæ, in the cure of cataract by the gradual removal of opaque material from the lenticular apparatus; and the fact of the removal of this opacity, is the more remarkable in this case from having occurred, not in the ordinary or healthy state of the system, but during the prevalence of a severe illness by which the patient was attacked some months after the occurrence of the cataract.

F. T., aged 43 years, was struck on the left eye by a small piece of iron, on the 12th April, 1852; the cornea, at its lower and inner part, was wounded, and the injury seemed to have extended to the iris; for after the accident, the pupil was altered in form, and drawn toward the injured part, and this change

seemed to have been more an immediate consequence of the injury, than an alteration produced by subsequent inflammatory action. On the 25th June, when I first saw the patient, the lens was completely opaque, and of a greyish-white colour; considerable irritation of the eye as yet prevailed with conjunctival injection, from which, however, with the aid of ordinary remedies, he, in a short time, completely recovered; the cataract, of course, still remaining, with the pupil somewhat improved in form by the use of belladonna. During some weeks I had seen nothing of the patient, when on the 4th November, 1852, he returned to me, and on examining the eye, I found the cataract cured as if by operation; a crescentic and opaque portion, apparently of capsule, being now observed at the outer and lower part of the pupil, looking very much like the condition often observed after the artificial breaking up of cataract, all the other part of the pupil being clear and black; vision had returned, and with the aid of a cataract glass, the patient could see things around him with the affected eye alone, and this happy condition of matters seemed to have prevailed during the previous week; and in connection with

its probable cause, he stated that, in the previous month of October, he had suffered from an attack of "Typhus fever," with considerable abdominal pain and disturbance, but without suffering in the head; and that he was confined to bed with this malady from the 21st to the 28th of the month, but afterwards recovered rapidly, and found also that his previously lost sight was returning. It could not be ascertained that he had taken, during his illness, any remedy at all likely to affect the condition of the eye, so that it is but fair to give nature the credit of the spontaneous absorption of the opaque material, which would seem to have disappeared during the prevalence of the fever, more or less in the same way that the superabundant fat of the body may have done.

This case shews how the lens, or how portions, or layers of the lens, may be spontaneously removed, under the influences of morbid action telling on the body generally, and even induces the inquiry as to the possibility of changes occurring in the form of the cornea, by virtue of a loss of substance, which may have taken place during some morbid or cachectic condition of the system; in connection

with which, a case previously noticed, may again be alluded to; where a remarkable alteration in the form of the anterior part of the eye occurred during the progress of a case of small pox,—so that the patient, after recovery from the variola, was compelled to wear a pair of spectacles, which corrected the abnormal refraction produced by the new condition of the transparent parts of the globe.

The following is an interesting case of conical cornea, evidently arising from inflammatory action:—

M. E., æt. 16, a fine, healthy-looking young woman, was born in Liverpool, but at the age of 5 years went to Egypt, where she remained with her parents until the age of 10 years, residing during most of the time at Cairo, where both she and her mother suffered from ophthalmia. While in Egypt, she says that her eyes were "always diseased," and for a great part of the time, her suffering with them was extreme, complete blindness now and then prevailing. The left ophthalmia was much more severe than the right; she was attended by two surgeons, one an English, the other, a French gentleman; and says that blisters were applied behind both ears, and that

a small quantity of a white powder was for some time blown into the left eye twice a day; she took a good deal of medicine, but never had her mouth particularly affected by it; castor oil was for a long time taken every morning, and collyria were frequently employed.

Before she left Egypt the left eye had improved, but on her voyage home, in the Oriental Steam Packet, it got worse, and, on this account, after her arrival at Southampton she was again under surgical treatment; the left eye at this time was blind, and on three occasions the extract of belladonna was applied to the lids, but without any effect on the sight.

The catamenia appeared at 14, and have been regular ever since. The eyes are grey, with a very slight admixture of blue; the right eye is healthy and strong, so that she is able to read or sew, with its aid, for a considerable time; but the feeling of weakness occurring in the other eye, compels her to lay aside such occupations sooner than she would otherwise do.

The right eye being healthy, further remark need not be made about it; so that the remaining notice may be confined to the left, or diseased organ.

When the eye-lids on both sides are closed, and the eye-balls examined by the touch, it is easily felt, even through the lids, that the left eye projects forward farther than the right, whence, upon the whole, the left eye feels larger than the other. The general form of the cornea, as seen in lateral view, is that of a truncated cone; the base, of course, corresponding to the sclerotic margin of the cornea; the truncated apex being opposite the pupil. The flattening down of the point of the cone, has probably been a consequence of ulceration and concomitant inflammatory action, of which vestiges are seen in the flattened part, which displays a whitish opacity, or rather nebulous condition, through which the light in part passes, saving at one little point, opposite the lower part of the pupil, and not larger than the head of a pin, where the opacity is of a dense white, and where an ulcer may at some former time have existed. This partial opacity near to the centre of the cornea, as well as the flattening of this tunic, seems to prevent that glancing and brilliant aspect which the conical cornea might otherwise have.

With the naked eye, there is no irregularity of figure to be observed in the cornea, beyond what has

been already alluded to, but with the aid of a powerful lens, it is found that minute deviations from regular curve are easily to be seen; these, however, are not angular, but rounded, and are doubtless the result of morbid action, as they are greatest as we approach the nebulous part of the cornea, and are much more remarkable than any irregularity of outline which can be seen in the right cornea, with the aid of the same magnifying power.

Upon the whole, the sclerotic has not so good, or so white an appearance as that of the opposite side; anteriorly, it seems slightly thinned, so that the blueish appearance of the choroid, as seen through it, is more visible than it should be; and the line of demarcation between this tunic and the cornea, is less sharp and fine than that of the opposite eye, for a sort of hazy ring, apparently derived, as it were, from the edge of the sclerotic, encircles the neighbouring margin of the cornea. The conjunctiva betrays the remains of former, and long-continued, inflammatory disturbance, hence the lining of the lids is much redder than that of the opposite side, while its vessels are relatively large and tortuous, where they correspond to the white of the eye.

The pupil has its normal situation, and is of medium size, and was soon widened by the application of atropine; its ordinary inactivity being in some measure accounted for by the little veil of nebulous cornea placed before it. With the naked eye the patient sees the light, but cannot see any object, either in the ordinary, or in the artificially-widened state of the pupil.

In the following case, conicity of the cornea was the consequence of accidental injury, and subsequent inflammatory action.

P. J., a man, æt. 34 years, was struck in the right eye by a portion of percussion cap, which started from the lock of a pistol, fired at the moment by a companion, side by side with whom he was standing; this occurred on the 14th of October, 1852, and now, January 14th, 1853, the state of the eye is as follows. A chronic ophthalmia of severe form prevails, the conjunctival and sclerotic vessels are much charged, so that the white of the eye is lost in the deep redness which the sclerotic portion of the ball displays; on the conjunctival lining of the lids a deep red is also seen, and the photophobia is great, although the vision of this eye is entirely lost.

The lens is opaque, and the iris is driven forwards by a partial dislocation of the crystalline body, while the cornea has assumed a conical form, the apex of the cone looking downwards, and corresponding to a point opposite the lower margin of the pupil, at medium dilatation. At the upper and outer part of the cornea is a cicatrix, which followed a wound inflicted at the time of the above-mentioned injury. The pupil is oval, the long diameter passing from the outer and upper to the inner and lower part of the iris.

In any case, where the cornea has acquired the conical form, and where this is the principal morbid alteration observed, it seems fair enough to give the name conical cornea to the affection; various differences may, however, be easily observed between cases that arise as consequences of severe, and, perhaps, long-treated ophthalmia, and others that occur, as it were, spontaneously, and without being preceded by any form of ocular disease which has attracted the attention of the patient; to which it may be added, that the latter more especially correspond to conical cornea, as described by most writers on this subject, and it is not improbable that

further observation and inquiry will lead to the determination of well-marked varieties in this group of ocular diseases;—whether these relate to the time, and mode of origin of the malady, to the forms assumed by the anterior part of the eye, to the conditions of texture, surfaces, or connections of the cornea, to the state of the iris and pupil, or to that of the retina or vision, or to the organic or functional derangements, general or local, by which the complaint may have been preceded, or with which it may be associated.

It is worthy of especial, and perhaps of repeated notice, that conical cornea is not particularly confined to any period of life; although it would seem to occur much more frequently to the young than to the old. As, however, it does present itself at ages so various, and in circumstances so different, it would be highly interesting to discover any one common cause to which its origin could often be referred. In connection with such considerations, the following case, which came under my notice in February, 1853, would seem to have a peculiar interest:—

M. A. C., æt. 3 months, was attacked by ophthal-

mia in the left eye when one week old, and at the age of three weeks the right eye began to suffer in like manner; purulent matter poured from both eyes,—from the right eye during about three weeks, from the left about two months; immediately after the purulent discharge abated, opacity of the left cornea was observed by the mother; this opacity is now seen on the outer side of the cornea only; while, on the inner side, the cornea presents a prominent and remarkable cone, with a peculiar glancing brightness, the apex of the cone looking directly forwards, its base corresponding to the inner two-thirds of the cornea, which portion looks peculiarly clear, and, as if thinned, where it forms the cone itself. The pupil is of moderate size; the eye-lids have regained their natural condition, saving that, when closed, the forward bulging of the cornea can be felt through them. The eye is evidently not blind; but the nature or amount of the vision cannot, of course, in such a patient, be accurately determined.

We have here presented to our notice a wellmarked case of conical cornea, evidently the result of ordinary infantile or purulent ophthalmia; a case in which, at one time, the eye was covered with pus, with diminution, without doubt, of the transparency of its corneal tunic, which afterwards is not only altered in form, but, in a considerable portion of its extent, has a more than natural brilliancy imparted to it.

If, along with the case just noticed, we call to mind the account of others, previously related, we cannot fail at once to see the connection which, in some instances, conical cornea has with previously existing ocular inflammation; be this, purulent ophthalmia, as it occurs in the new-born child,—the ophthalmia of hot countries, with peculiarities of soil and climate, such as are met with in Egypt, where the frequency of ocular disease is but too well known,—or be it some form of scrofulous disturbance, with accompanying inflammatory action, the bearing of which on complaints of the eye need not be further dwelt upon here.

In cases of conical cornea, following infantile ophthalmia, similar to that which occurred in the instance just related, it is evident that alteration in the form of the cornea follows morbid action which has previously existed on its anterior surface; and it is not unreasonable to suppose that in some instances the alteration of form in the corneal tunic may follow on morbid action from which its posterior surface has first suffered, as in cases where this malady appears to have been associated with conditions of cachexia and of internal ophthalmia; it is obvious, however, that the two corneal surfaces are very differently situated with regard to facilities for accurate observation, either during the progress of disease, or after its consequences are established.

The appearance of the disease in this instance reminded us of the interesting case related by Mr. Middlemore, respecting which he says:—

"I have seen one instance of this affection occurring only very partially, for the conical portion of the cornea was only as large at its base as the plane surface of a small split-pea; it existed at the lower part of the cornea, resembled a small and extremely conoidal portion of beautifully-transparent glass placed upon the surface of the cornea, and occasioned great confusion of sight from the unequal refraction of the rays of light. The appearance of the disease was extremely singular, and exhibited the nature of

the affection in a manner which could neither be mistaken nor misunderstood."

In the one case, the cone was raised on the inner, in the other, on the lower segment of the cornea; in the first instance the alteration of form was preceded by inflammatory action, in the second, it does not appear that previous inflammation had been observed.

Cases of conical cornea in which the base of the cone rests upon some part of the cornea, the remainder of the tunic not being affected by the abnormal elevation, appear to be worthy of particular notice; for some authors have asserted that the malady is nearly always observed in both corneæ, while instances such as the above-mentioned completely show that it may be confined to a part even of one cornea.

The part affected may or may not correspond to the centre of the cornea—in the cases just related the elevation was away from the centre; but in another case, not less interesting, related by Vidal, there was seen a sort of nipple on the centre of the cornea, clear and bright as crystal; the patient was an old lady of 70, extremely myopic, and along with the conical corneæ had cataracts, which were operated on with complete success; and after the operation it was found that for reading, which she had to practise in the teaching of children, she did not require the aid of cataract glasses; on which account the case has been noticed by some writers as favourable to the theory of Sir Wm. Adams respecting the depression or breaking up of the healthy or diseased lens, when the cornea in front of it is conical—on the supposition that where the conical cornea refracts the light so much, the additional refraction of the lens only assists in confusing vision, which would therefore be better without the aid of the lenticular body; the optical question connected with this matter may be further noticed hereafter.

Conical cornea may not only follow disease of its anterior or posterior surfaces, where the conjunctiva or the membrane of Decemet have previously suffered, but it may also be the result of morbid action, which has first attacked the sclerotica and afterwards the corneal tunic; of this statement illustrations are occasionally seen amid cases of ophthalmia associated with rheumatism in different parts of the body, one consequence of which, now

and then met with, is dropsy of the anterior chamber, sometimes with rounded, at others with conical prominence of the cornea.

A young theologian observed a bluish spot in his right cornea; it gradually increased in size, and in the course of fourteen days the same kind of aspect was acquired by nearly the whole of this tunic; the appearance was compared to that tint of blue which is seen on milk whence the cream has been removed; the middle of the cornea had assumed a conical form, the apex of which had more of the blue appearance than was observed in the surrounding parts, the greater part of the cornea not being deprived of its transparency, nor the conjunctival or anterior surface of its smoothness. There was a small cicatrix of long standing on the cornea, but no further morbid appearances; the iris and pupil were in normal condition. It seemed that the above-mentioned conical form of the cornea was the result of inflammatory softening of its substance, in consequence of which it was not able to withstand the pressure exerted by the aqueous humor. After the patient had used the ointment of red precipitate during one month, the greater part of the cornea had regained its clearness, the conical form was much lessened, and the vision had greatly improved. This patient died several years afterwards of hydrothorax; so that Fischer, the distinguished ophthalmologist of Prague, who observed and treated the case, speaks of it in his "Klinischer Unterricht," as one in which a dropsical affection of the eye preceded, although by a long time, a corresponding affection of the serous sacs of the chest, by which life was extinguished. With regard to this case further details are not given by Fischer, but the patient is spoken of as a young theologian in such a way as permits us to suppose that he was probably a hard-working divinity student, giving as little rest as possible to his eyes, and thus allowing a constitutional tendency to tell at an early period upon the condition of a delicate and over-strained organ.

As cases of this kind, occurring to literary and studious men, have a peculiar interest, from the great efforts to which the eyes of such readers are inevitably subjected, the following, so concisely related by Lawrence, may here be added:—

"An old clergyman, who was the subject of this

affection for nearly thirty years, was enabled to continue his duty in the pulpit with tolerable accuracy to the time of his death, which happened when he was about seventy. The apex of the cone had become opaque in his case; the opacity was diminished by the solution of the nitrate of silver, and he employed belladonna to enlarge the pupil."

Here allusion might also be made to the old lady operated on by Vidal; the patient was a schoolmistress by profession, and was of necessity much employed in reading, if not in looking at various and minute objects.

Every careful observer of diseases of the eye must have noticed the apparent connection between ocular complaints and derangements of the pelvic viscera; hæmorrhoidal affections, for instance, frequently precede and accompany amaurosis; and the same malady is now and then met with in conjunction with various pathological states of the uterine system; and the occurrence of nyctalopia, or of other forms of partial or periodic amaurosis, as a consequence of masturbation, which has more than once come under my observation, is not unworthy of particular notice in this place;

for it would not seem unreasonable to suppose that any morbid condition capable of exerting an important influence on the nutrition, vital state, and function of the retina, might also tell on other parts entering into the composition of the eye-ball; so that the occurrence of conical cornea along with continued inactivity or derangement of the uterine system, need not be regarded as more extraordinary than the associated phenomena already alluded to: a statement which may be closed by the further expression, that amenorrhæa and chlorosis have been frequently observed as the forerunners and companions of pellucid staphyloma.

It must also be borne in mind that in cases of conical cornea, observers have often met with diseased states of the retina, the symptoms of partial amaurosis, accompanying, not unfrequently, the physical characteristics of hyperceratosis; and we have had opportunities of studying these complications of ocular disease along with marked derangements of the pelvic viscera; instances of this kind might lend themselves with some prospect of success to the nauseating or emetic treatment, or to the administration of chalybeate preparations, and better

still, perhaps, to the employment first of the former, and afterwards of the latter plan.

In cases where derangements of the pelvic viscera have preceded the occurrence of conical cornea, or where they are found to accompany this affection, it is of importance to attend particularly to the state of the head; as in some instances, headache, with fulness of the cerebral vessels, will be found to have occurred before the patient suffered from any ocular complaint. Mr. Lawrence mentions the case of "a young woman from the country, who laboured under this affection," and who "had symptoms of congestion in the head, which were relieved by cupping, and the sight was assisted by using concave glasses."

A case of conical cornea was observed by Arlt, in a chlorotic girl of sixteen.

The following is another, which has been described by the same observer. Mad^{no} G. was eighteen years of age in 1846, when her eye-sight became so defective that the approach of amaurosis was feared; in the left eye, vision was very imperfect, while that of the right was dazzled and confused, and when the patient was first seen by Arlt, these morbid conditions had been increasing during the previous eight weeks.

The cornea was perfectly clear and smooth, but in advance of its true position; the centre of the cone was a little above the mathematical centre of the cornea, and slightly to its outer side; the cornea, when viewed side-ways, reminded the observer of a window-pane with a prominent, rounded, and moveable piece, or whirl, fitted into it. There was no opacity, and no apparent disease of the substance of the cornea, no lacrymation, photophobia, pain, or vascular injection. In reading, sewing, or viewing near objects, the defect of vision was much felt, and led to the occasional covering of the left eye; nevertheless, with the left eye, near objects, although not clearly seen, were better discerned than those at a greater distance, but the organ was fatigued even with but little effort. The patient had suffered more than three years from chlorosis, and was without doubt the subject also of tubercular disease, from which she had already lost two brothers. A little while before the occurrence of the ocular complaint, the young lady suffered, during several weeks, from a very severe facial neuralgia, which she attributed to the influence of cold. Two years after the occurrence of the malady, the apex of the cone became slightly opaque, and afterwards remained during

three years with very little alteration; there was no apparent inflammation, and no loss of substance.

General treatment was thought more important than local; well-regulated diet, bathing, and recreation were attended to, and preparations of iron were on different occasions employed, and that for a considerable time.

Amongst topical applications, laudanum, and a weak solution of nitrate of silver, were employed. The treatment was followed by some improvement; the left eye became gradually more accommodating, allowing the right to be longer used than before, but the patient was not enabled to look at minute objects for any considerable time. At three inches' distance, she could read the smallest print with the left eye, and could distinguish her friends four paces off, but not more; the general health was very much improved.

Whether or no any optical contrivance was resorted to in this case, with a view to the improvement of vision, is not stated by the Bohemian surgeon.

Various opinions have been entertained by different writers respecting the influence of uterine affections, such, for instance, as dysmenorrhæa, on the production or aggravation of conical cornea; some, such as Juengken and Sichel, thinking it great, while others have been unwilling to attach any considerable importance to it, or unable to discern the possible connection of the two.

It may, nevertheless, be admitted, that certain conditions of the uterine system do tell upon different parts of the eye. Amaurosis is now and then met with as a consequence of abortion and parturition, and that in cases where it does not seem fairly attributable to the associated loss of blood. M. Sichel has described a peculiar form of ophthalmia, connected with derangements of the function of the uterus; and there lately came under my notice a young woman who lost the left eye from a violent ophthalmia, following an exposure to wet and cold, which caused suppression of the menstrual discharge, at that time going on: in this case, the interruption of the uterine function, had, doubtless, contributed to the severity of the ocular complaint.

It is tolerably evident, therefore, that the retina and conjunctiva may sympathise, if this expression be permitted, with morbid and altered conditions of the womb; and that the cornea should share in such sympathy need not seem very surprising.

Here we may also mention the occasional occurrence of strabismus soon after conception, — its prevalence during pregnancy, and its disappearance after delivery,—as another illustration of the sympathies, now and then observed, between the generative organs and the apparatus of vision.

The occurrence of squinting, in the manner just mentioned, is undoubtedly rare; but other sympathies of the organs alluded to are much more frequent; for it must be borne in mind that amaurosis is often observed as an association of the chlorotic, as well as of the pregnant state; and that it may follow excess, or sudden suppression, of the lacteal secretion, or of the menstrual, leucorrhœal, or lochial, discharge.

The cases of conical cornea observed by Rosas, occurred mostly in scrofulous girls under fourteen years of age; and Andreæ treated several cases of this ocular malady in very scrofulous women, who had suffered from syphilis long before the corneal affection began.

Three cases, related by Pickford, and which were

improved by the nauseating and other treatment, were observed in women of the respective ages of twenty-one, twenty-seven, and twenty-eight years.

The patient of twenty-one had suffered from hysteria; the conical cornea affected the left eye only, and was perfectly cured after twelve months' treatment; but after the lapse of thirteen months more, the malady again returned, and the treatment was repeated with equal success. The patient of twenty-seven was a sempstress, who had well-marked conical cornea on the left side; after three months' treatment it was improved, the cornea having become flatter; in two months more, further flattening of the cornea and general improvement had taken place, and the patient could see better than before; fourteen months after the commencement of the treatment great improvement was observed.

In about five months afterwards the malady returned, and was again cured by the same treatment continued during another year, after which the patient was able to resume her occupation. These relapses and second cures appear to me worthy of especial attention. In the patient of twenty-eight, the left eye was also affected; but the right did not

appear altogether free from a tendency to the same malady.

Chelius relates a case of conical cornea in a young woman of twenty, which was improved by a seton at the back of the neck, along with the administration of purgatives, burnt sponge, and digitalis, accompanied by the rubbing of iodine ointment on the parts around the eye. Such report of the good effect of an anti-strumous treatment in a case of conical cornea, seems worthy of particular consideration.

Congestion of the eye-ball or its appendages may suddenly, or gradually, lead to alterations in the refracting power of the eye; in such cases, changes in the form of the cornea may now and then occur, and although conical cornea may hitherto have been scarcely met with as arising in this way, the cases of myopia that do present themselves are not unworthy of notice, on account of analogies in the chain of observation in which they may hereafter be found as connecting links.

In a case related by Dr. Smith, a person suddenly became myopic on coming out of a cold bath. An officer was attacked by the same ocular malady A lady who was excessively far-sighted, became near-sighted during a severe attack of conjunctivitis, and presbyopic again after recovery from her ophthalmia, (Desmarres). A lady, mentioned by Mr. Tyrrell, required concave glasses to relieve her myopia, while suffering from granular lids, (W. W. Cooper.)

In such instances the humours of the eye may have been altered in quantity or quality; but it is also possible that the cornea may have been influenced, either alone, or along with changes in the retina, and other parts.

Whether myopia, or conical cornea, or other affection of the membranes or humours of the eye occur in connection with derangement of the general health, along with any local or organic congestion, or after the suppression of any recent or accustomed discharge, or as an apparent consequence of any debilitating cause, it is obvious that attention should first be directed to the morbid conditions with which the ocular malady is apparently associated, and that the primary treatment should be planned accordingly.

Walther met with a case of conical cornea in the right eye, after a severe attack of blepharophthalmia, in a scrofulous man, twenty-one years of age. The conical cornea was first noticed after the affection of the eye-lids had existed two years; the apex of the cone was of a greyish white, but elsewhere the cornea was bright and clear. This apex was a little away from the corneal centre, or towards its inner and lower part. The iris was in normal condition. The patient saw things, even distant objects, "distinctly" (?) but as if through a mist. Geometric figures, triangles, or squares, he distinguished as such; but lines ruled nearly together seemed to run into one another. The light of a taper was seen to be surrounded by prismatic colours. The cornea had no sparkling aspect in any position in which it could be observed.

In a case of right and left conical cornea, observed by Schön, both corneæ sparkled like crystal, so that the pupil could not be distinctly seen; this aperture, however, did not appear to be contracted, and the mobility of the blue iris was retained. The patient was a cachectic man, thirty-one years old, extremely, myopic from his childhood, afterwards amblyopic, and next amaurotic, so that along with the conical corneæ, as observed by the Hamburg anatomist, but

very little sight remained. In these conical corneæ, observed when of eight years' standing, the middle point of the cone on both sides was a little below the middle of the tunic; the right cone was perfectly transparent, but the left, at its apex, a little cloudy.

Such facts are in part opposed to the doctrine of Sichel, who was of opinion that opacity was always discoverable in the neighbourhood of the apex of the cone; in connection with which, the two cases observed by Lhommeau, in Berard's Clinique, might also be mentioned; in one of which the entire cone was perfectly free from any trace of opacity,—a fact, determined as well with the lens as with the naked eye.

Here it may be observed, that, in many cases of conical cornea, which are met with as results of inflammatory action, the cornea is marked with opacity of varying extent; this too, frequently affecting the apex of the cone,—and that in some instances the lenticular system does not altogether escape: of this statement the following cases may be given as illustrations.

J. W., æt. sixteen, a strong boy, with dark hair and dark eyes, had no ocular complaint until the age of nine, when he suffered from a severe attack of small pox; the variolous affection was accompanied by inflammation of the left eye, which prevailed more or less during about two months, and then left the patient with conicity of the left cornea, and with an opaque state of the summit of the cone, which summit is a little below, and a little to the outer aspect of the corneal centre.

The opaque part of the cornea seems thickened, and the anterior chamber somewhat enlarged; the iris and pupil, as seen through the clear circumference of the cornea, have their normal aspects, corresponding well with what is seen on the opposite side; but behind the centre of the pupil, a small cataract, not larger than the head of a pin, apparently seated in the anterior part of the capsule of the lens, is seen.

J. H., æt. sixty-six, a healthy man, had good eyes and sight until the age of forty-six, when the right eye suffered from inflammation, and ever since has gradually got worse in its vision, so that at present it is but of little use.

Disease of the left eye afterwards began, and that at a time when he was engaged doing very fine work as a shoemaker. The conicity of the left cornea is remarkable; its apex, central, sharp, and opaque; red vessels also meander on the corneal surface; there seems to be a little thickening of the tunic at the central or opaque part, and the aspect of the cornea as a whole, shows how small an amount of deposit, or how trifling a degree of additional substance, on the exterior of the corneal centre, would be sufficient to alter the spherical to the conical form.

W. H., æt. thirteen, a healthy boy, with dark brown eyes, had scarlet fever in December, 1852; ophthalmia, affecting both eyes, accompanied this malady, and on recovery he was left with opacity of the lower part of the left cornea, with a rather small and apparently fixed pupil; the opaque part of the cornea presents a conical elevation, corresponding to the lower half of the affected tunic. But little vision remains.

M. S., æt. fifteen, a healthy-looking young girl (in all except the aspect of her eyes,) suffered much from ophthalmia, between the ages of ten and thirteen, and at this period of life the accompanying trichiasis rendered the evulsion of the ciliæ from time to time necessary; the eye-lashes have now regained their

normal condition, but the left cornea is conical, the apex of the cone corresponding to the lower and inner part of the cornea; the lower part of the conical cornea is opaque; light is seen, but the patient has no vision of objects.

When the eye is raised, the upper lid, being stretched over the apex of the cone, gives a peculiar appearance to the organ: the aperture of the lids in this state is more or less triangular; the margin of the lower lid represents the base of the triangle,—the apex of the cone, over which the upper palpebra is bent, divides, as it were, this eye-lid into two parts, which represent the other two sides of the triangle. The right cornea presents no morbid appearance; and the sight of the right eye is good.

W. C. D., aged thirteen months, was attacked by purulent ophthalmia when three days old; the consequence has been an apparent flattening of the right cornea, with opacity of its inner half, and in the left eye a remarkable conicity of the cornea. The base of the cone is less than the cornea, and is placed a little towards its inner and lower aspect. The apex is opaque, and projects beyond the hids; and there is a sort of

inferior strabismus, by which the prominent cornea is pressed upon the margin of the lower lid, which is thus bent beneath it in a very characteristic manner.

- W. I., seven weeks old, had purulent ophthalmia within the first week after birth; the central part of the right cornea is now conical and opaque; it is also softened, and the iris is driven forward into the cup of the cone. As in the last case, the affected eye is constantly directed downwards, so that the cornea rubs against the lower tarsal margin.
- J. A., æt. six years, suffered from purulent ophthalmia; the left eye was attacked on the third day, the right on the tenth day after birth. At five weeks old, an eruption on the scalp appeared, and henceforth the ocular inflammation diminished, and soon vanished entirely. From exposure to cold, at the age of twentynine months, he had another attack of inflammation in the eyes, which continued during fourteen days; again an eruption of the scalp appeared, and again the ophthalmia immediately abated. The first eruption on the head prevailed during

eighteen months; the second and last continued twelve months; and during both these periods the general health was good; and it is so at present. The eyes are very sensitive to impressions of damp or cold, - becoming suffused and injected from very slight causes of this kind. Both corneæ are conical; the cones are tolerably central, and their apices are affected by a barely visible trace of opacity, or rather nebulosity, which, in the left eye, is discerned with less difficulty than in the right. The images of a taper held before the eyes are very small; the iris and pupil, on both sides, appear normal, phosphènes would seem to be good, and the retinæ apparently sound; when requested to look at a printed page, the little patient places it about two inches in front of his eyes; but his mother reports that his ordinary way of looking at small objects is by holding them somewhat to the outer side of his right eye.

As far as the form of the cornea may be concerned, it is worthy of remark, that, amongst the consequences of ophthalmia in new-born chil-

dren, we see — 1, the cornea unaltered as to form; 2, irregular prominence of the cornea; 3, spherical prominence of the cornea; 4, conical prominence of the cornea; 5, flattening of the cornea; 6, extreme flattening, sinking, or depression of the cornea; all of which are at least worthy of mention in this place: for, although some of these alterations are more frequently associated with staphyloma than with transparent and conical cornea, we now and then amongst them meet with cases of transition, as it were, where the one form of disease seems to pass into, or to be blended with the other.

G. S., æt. thirty, a healthy-looking man, has conicity of both corneæ, with opacity of the apex of the left cone, and a very slight degree of haziness on that of the right; the malady is attributed to an attack of ophthalmia, from which the patient suffered when ten years of age.

There is a roughened surface on the fore part of the left cornea, looking like a result of ulceration; the pupils are in normal condition; and the sight of the right eye is much improved by a concave cylindric lens.

E. C., æt. twenty, has lost the tarsal margins of both eye-lids, on the right side, by an uncontrollable, or at any rate uncontrolled, ulcerative process, which followed a "stye" on the upper lid, from which she suffered at the age of thirteen. The conicity affects the lower part of the cornea, the prominent portion of which has become hazy; and red vessels run towards it from the neighbourhood of both canthi. In this case, the conical cornea was an indirect result of irritation and inflammatory action, associated with palpebral disease, which does not seem to have been connected with any other local ailment, or general morbid condition of the economy.

J. L., a man, æt. sixty-five, had measles at ten years of age, and "weak eyes ever after." Both corneæ are conical; the cones opaque and truncated; and the little vision which the patient enjoys appears to take place through the upper part of each cornea. The cones have evidently been truncated by the ulcerative process, both displaying considerable irregularity of surface, apparently due to this morbid action.

A. C., æt. thirty, a female servant, had good eyes until the age of twenty-two, when a feeling of roughness occurred inside the left upper lid, which was followed by severe general ophthalmia, whence an increased prominence of the cornea, in an irregularly conical form — the apex of the cone at the upper and outer part. The opacity is most remarkable at the lower and inner part of the cornea. There is synechia anterior — obliteration of the pupil — external strabismus — and total blindness of this eye; the opposite organ being sound and its vision good.

By passing in careful review a great number of cases of conical cornea, it will occur to the observer, that this disease has at least two apparently very different modes of origin: 1, Occurring without any previously existing inflammatory action of which the patient or his attendant has been able to take cognizance, and most frequently in feeble, cachectic, or impaired constitutions; in these cases inflammatory action, and consequent opacity, may follow the development of the disease, from irrita-

winking motions, more especially when the cone has become very prominent; or by the atmosphere, or other external agents, acting upon the advanced and prominent corneal surface; the cornea in many of these cases remains long transparent and bright, and is now and then altered as to its thickness; and the base of the cone, in its outline, may correspond with the circumference of the cornea, or with some lesser portion of its surface; the direction of the cone being sometimes directly forwards, at others inwards, outwards, upwards, or downwards.

2, Occurring after previously existing inflammatory action, acute or chronic, severe or barely discernible, of a part, or of the whole of the cornea, with, or without more extensive ophthalmia; often, in patients who are otherwise healthy and strong, the cornea, in many cases, more or less affected by opacity; the apex of the cone often opaque, and not unfrequently betraying the vestiges of former ulceration in visible cicatrised spots; now and then the cornea is considerably altered in thickness, while the cone may vary in size, position, or direction, as in the first class of cases.

It is perhaps doubtful whether, in any case, the cornea becomes conical without some alteration in its nutrition, be this called perversion, diminution, or excess; in other words, the change of form is rather connected with a process of morbid growth, than a mere result of distension. Along with this observation, however, we must bear in mind the fact, that in post-mortem examinations of conical cornea, alterations of thickness in the affected tunic have not always been met with; it might not therefore be amiss to remark, that if we entertain this view respecting the altered nutrition of the cornea, that the first class of cases may be spoken of as instances of conical cornea from alteration in the nutrition of this membrane without visible traces of inflammatory action; and the second class, as cases of conical cornea, also from perverted nutrition, but preceded or accompanied, or both, by the visible phenomena of inflammation; or, in fewer words, cases of conical cornea, produced by keratitis, or by some more widely spread form of ophthalmia. After more numerous autopsies have been made, it is not improbable that the apex of the cone or part of the cornea most affected, may often be found thin in cases of the first class; while such atrophy seems less likely to be observed in those of the second class.

With regard to the first class of cases, it would be highly interesting to determine, if possible, the manner in which the nutrition of the cornea may fairly be supposed to be perverted,—in connection with which the thought suggests itself, that some altered condition of innervation might here be taken into account.

In the report of one case of conical cornea, partly related at page 62, we have the remark, that "at the age of 19, a scrofulous affection manifested itself on the neck and neighbouring parts; where, from this age to that of 23, open scrofulous sores existed, the cicatrised remains of which are seen at present over the whole length of the right sternomastoid muscle, in the lower part of the neck, immediately above the sternum, as well as beneath the left ear." To suppose that the cervical ganglia of the sympathetic may have been disturbed by the progress of such morbid action, would perhaps be allowed as a reasonable assumption, in connection with which the results of experiments on these ganglia may be named:—

After removal of the superior cervical ganglion, in dogs, it has been observed, that the secretion of tears and mucus is increased, and that redness of the conjunctiva comes on.

In the patient alluded to above, great suffering prevailed in the head during about three months before the dimness of sight associated with conical cornea occurred; whether or no this could be fairly attributed to any morbid condition of the fifth cerebral nerve, cannot, of course, be very satisfactorily determined; but it is well to bear in mind the fact, that the division of this nerve, especially if practised in front of the Gasserian ganglion, is soon followed by "destructive inflammation" of the eye; such considerations suggest at least the importance of careful inquiry respecting the condition of the cerebral nerves, but more especially of those connected with the eye-ball, or its appendages, in all cases of perverted nutrition of the cornea.

Relating to this matter, Arlt has the following observations, in his work on Diseases of the Eye, which is now in course of publication:—

"Fodera, Mayo, Majendie, and others, have shown the influence of the nerves on the life of the cornea; and in connection with this subject the

results of the researches of Szokalsky, Longet, and Pappenheim, may be briefly communicated:-'After the division of the Trigeminus nerve in front of the Gasserian ganglion, sensibility in the parts supplied by this nerve is first lost, and the conjunctiva is deprived of feeling. The pupil is extremely contracted, but does not lose its power of alteration with the varying conditions of the light. After a few hours the pupil becomes wider, but still retains its mobility. On the second day the cornea begins to lose its transparency, this change being first observed at the centre; while its exterior surface retains its natural smoothness. Examined anatomically at this time, the central or most affected part of the cornea appears thicker than natural, without any trace of new formation being discoverable in its structure. If the animal on which the experiment has been made be kept alive, about the eighth or tenth day the cornea is milk-white, and as if swollen; the central opacity having gradually spread towards the circumference until every trace of transparency is lost. Anatomically examined at these periods, the cornea is found still more thickened, not merely from watery deposit,

but by organisable granular exsudation. If the animal live, the next remarkable change is a softening of the central part of the cornea, the conjunctival surface comes off, and the cornea itself, layer by layer, falls away; next to the sloughing of the cornea is the loss of the contents of the eye-ball. When the morbid process, just traced as occurring in the cornea after the division of the trigeminus nerve, is carefully considered, it will be found to differ materially from what we observe in inflammation. Neither Dr. Pappenheim nor myself, amid our numerous observations, could find anything like lymph or pus globules; granular exsudation and the small detritus of fibres of the cornea were all that we could find in the disorganized material or remains of the corneal texture. It must also be remarked, that when the division of the nerve is practised between the Gasserian ganglion and the brain, sensibility is lost, but the cornea retains its transparency; whence it seems that the loss of transparency and the destruction of the cornea, depend in reality upon the destruction of the Gasserian ganglion, and upon that of the great sympathetic nerve, which is closely connected with the

ganglion as well as with the ophthalmic branch of the third."

In his report of experiments made on kittens, "Forsög angaaende Virkningen af Extirpationen af Ganglion cervicale supremum paa Öiet," the celebrated Danish physiologist, Hannover, has shewn that after removal of the superior cervical ganglion, the cornea is one of the parts in which pathological effects may be observed.

In one kitten operated on when four days old, the superior cervical ganglion was removed on both sides; as well as two and a half lines of the neighbouring part of the sympathetic nerve on the left side; on the sixth day after the operation the wounds in the neck were healed, and on the four-teenth day after it, ulceration of the middle of the right cornea was noticed.

A contracted state of both pupils was another remarkable phenomenon seen amid the effects produced on the kitten; while, in another kitten, where the same operation was performed on the right side only, (the ganglion, with a line and a half of the nerve, being removed,) the left pupil was found to be widely dilated, but the right, or that on the

opreated side, was contracted, not, however, in so great a degree as were the pupils of the other kitten.

"Even in 1712, the effect produced on the nutrition of the eye, as observed in the cornea, by dividing one half of the great sympathetic, was shewn in experiments practised on dogs by Pourfour du Petit."

The interest and value of some of these experiments is perhaps not lessened by the fact, that nature had performed them, after her manner, long before the distinguished physiologists in question discovered this method of interrogating her secrets.

In cases of disease of the temporal bone, such, for instance, as now and then follow affections of the ear, occurring during the progress of measles or scarlet fever, the fifth cerebral nerve, the Gasserian ganglion, and the ophthalmic, superior, and inferior maxillary nerves, passing from the front of this body, may one, more, or all become involved in the progress of morbid action; in such cases I have watched the origin of remarkable alterations in the cornea, which seems first to lose something

of its sensibility, soon after which its anterior surface displays a loss of substance, ulceration or absorption of the part having occurred, all the while the cornea may be transparent, and without vascular injection or other well-marked sign of inflammation. Such were the appearances in the case of a girl, 7 years of age, and now under my observation. Nevertheless, it was remarked, that after the above-named phenomena had existed about two days, another set of appearances presented themselves; and these seemed to depend on changes, occurring on the posterior surface of the cornea, or in the membrane of Decemet, which now lost its clearness, and became hazy and dull, and at a point immediately behind, or corresponding to the previously observed ulceration of the cornea, an opaque deposit, apparently of pus, was seen, rounded in form, and not exceeding the oneeighth of an inch in diameter.

Upon the whole the conditions observed seemed to suggest the idea, that along with the altered vitality of the parts affected, the insensibility of the anterior surface of the cornea, or of its conjunctival coating, had led to a loss of that protection which is afforded by the winking movements of the eyelids; hence the atmosphere itself, as well as the dust with which it might be charged, along with the detained tears and mucous secretion, would be the more likely to injure the delicate surface of the front of the eye, to say nothing respecting the transparent nerves of the cornea discovered by Schlemm, and derived from the nervuli ciliares, or of the possible effect on the nutrition of the membrane, which their indirect injury might cause.

In studying the causes or modes of origin of conical cornea, the complicated nervous system of the face should not be overlooked, while the nerves in the dental arches, which are so much exposed to sources of irritation and disease, seem to be especially worthy of attention; for although these remarks may at first sight seem to be rather away from the subject of conical cornea, we have only to call up a recollection of that which belongs to disease, which in its origin may be connected with reflex phenomena, to be enabled to conceive the possibility of the pathological concatenation here alluded to.

Believing that these considerations, relating to the morbid condition of the teeth as met with in some cases where conical cornea exists, are of importance in a practical point of view, a short illustration may not be altogether out of place.

A. B., æt. 30, a weaver, from the neighbour-hood of Wigan, a stout, healthy-looking man, of short stature, consulted me on account of disease of the right eye, in June, 1853. The cornea was conical; the apex of the cone nearly central, and opaque; in the sound eye a blue iris was seen, but in the diseased organ this membrane had assumed somewhat of a greenish tint; the pupil in its centre being of medium size and regular in form, but immovable, or unaffected by the ordinary changes of light.

When the two eyes were tried with a view to the production of phosphènes, these phenomena were normal in the left eye, but incapable of being produced in the right. With the right eye, the patient cannot see any object; in short, he barely perceives the illumination produced by a lighted taper held before this eye, when the opposite organ is covered.

. The dental arches are in very bad condition, many teeth have been entirely lost, while of others, loss of teeth took place between the ages of 18 and 25, several having been destroyed by decay, while others were extracted. These observations apply to both jaws, and to both sides of each. The patient says that along with the tooth-ache the right eye suffered very much, and that in the right side of the upper jaw two of the teeth were much more painful than the rest; and he further remarks, that heretofore, when these teeth ached, the right eye always became inflamed.

In this case it was clearly made out, that the dental preceded the ocular disease, and that after the occurrence of the latter it seemed to be aggravated by the continuation of the former; the disease within the jaws seemed to have produced neuralgia of the eye, on which deep-seated inflammation of the eye-ball appears to have followed; and of which the present state of the organ is doubtless a consequence. The insensitive retina, the fixed pupil, the altered colour of the iris, the injected sclerotic, and the conical and opaque cornea, may now be regarded as a group of strongly marked vestiges of former morbid conditions, actions, and changes.

The intense pain often felt in the eye-ball at the moment a tooth is separated from the jaw, in the act of extraction, is an illustration of the nervous connection of the two parts, which we are told can scarcely be sufficiently appreciated except by those who have felt it.

It would not be difficult to adduce other illustrations of sympathy (to keep to the old term) between the dental nerves and those of the visual apparatus, and for which the ramifications of the trigeminal and sympathetic systems mainly account; and it is especially worthy of notice, that in some of these cases the eye is much disturbed in its nervous system; in others, in its vascular system; in a third class, in both.

F. P., æt. 30, had suffered violently for upwards of twelve months, first with neuralgic pain in the left temple and eye, and afterwards with pain more especially confined to the eye-ball itself, the torture being so great that the patient resolved to have the organ extirpated if necessary; and, with this view, consulted Professor Galenzowski, of Wilna, who found that the first upper molar tooth on the left side was carious. This tooth being removed, a foreign

splinter of wood, about three lines in length, which had traversed the centre of the tooth, and had probably been introduced in picking the teeth. A probe passed from the socket into the antrum, from which a few drops of thin purulent fluid escaped. The pain ceased almost entirely, and, on the same evening, the eye began to be sensible to light, vision gradually improved, so that on the ninth day the patient could see as well with the left eye as with the right, after a blindness of thirteen months."

In a case which recently came under my notice, a gentleman suffered severe pain in the left eyeball, which had already continued for several weeks, and the sight of the organ was considerably impaired; the pupil was a little more contracted than that of the opposite side, but was less sensitive to changes of light: this gentleman dined at six, and the ocular affection was frequently worse in the evening.

On examining his mouth, I found that he had "a piece of teeth" in the upper jaw on the left side, based on a gold plate, in connection with which there was some soldering of another metal. I recom-

mended the artificial teeth to be laid aside, and requested the patient for a time to do as well as he could without them; this advice was taken, and at the end of the first week after there was no more ocular complaint.

In this case it appeared to me that the foreign body in the mouth was probably the cause of the diseased condition of the eye; but whether any galvanic or other action, due to the presence of metals, were added to the irritation mechanically produced, cannot be satisfactorily determined.

It might be said that such cases have no connection with conical cornea; to which, however, it may be replied, that the cornea is an important part of an organ, which may suffer, as a whole, in these, and in many other equally curious ways; while it is obvious, that in any case, where conical cornea exists, and where its cause has not been determined, the state of the nose and mouth, but more especially of the jaws and dental system, are matters not unworthy of the attention of the practitioner.

Before leaving these considerations, relating to disturbances in the nervous system of the eye, it

may be remarked, that the prognosis in cases of conical cornea, must generally be unfavourable, when any such morbid complication exists; whether this be want of sensibility in the retina, or diseased state of the nerves or ganglia, in the neighbourhood of the orbit, affecting either the nutrition or sensibility of the organ, the movements of the iris, or those of the globe of the eye.

Oscillation of the eye-ball, a phenomenon not unfrequently associated with amaurosis, has been observed in connection with conical cornea.

In advanced cases of conical cornea the iris is said to have been found tremulous, from the abundance of aqueous humour, — and, at the same time, concave on its anterior surface. It may be a question, whether such tremulous condition of the iris may not sometimes depend on alteration in the vitreous, as well as on that of the aqueous humour; and whenever such alteration in the vitreous humour seems probable, particular attention should be paid to the condition and position of the lenses, either or both of which may be altered, as a remarkable case, previously related, tends to show. Such considerations might be especially important in any case

where operation on the eye-ball, but more especially upon the lens, might be contemplated; as there is every reason to think that it would be worse than useless to attempt any operation on the lens, if this body had been previously dislocated, absorbed, or both, or even if it had but partially undergone either of these alterations.

In a case related to me by a distinguished optician, a tremulous state of the iris was observed, along with conical cornea; the vision of the patient was very confused, and was not in the least assisted by any form of concave lens.

In one case of conical cornea, observed by Chelius, the polyopia was so remarkable, that a candle held before the eye was seen as fifty or sixty, by the patient. This phenomenon is attributed, by Chelius, to the different thickness of different parts of the cornea, and hence to its having, in different points, different refracting powers. Hence we see that Chelius ascribes to alterations in the thickness of the cornea, that which Sir David Brewster has ascribed to alterations or inequalities on its surface.

These opinions seem, however, to be based on no great number of observations, which, if frequently repeated, might give additional interest to the subject, by adequate confirmation of the view of either of these eminent men.

It may, however, be remarked, that neither irregularities of the surface, nor alterations in the thickness of the cornea, are essential to the production of polyopia, as we have more than once met with it without these, as in some cases of cataract, in amblyopia, associated with morbid conditions of the abdominal viscera; and, now and then, continuing for several weeks, after accidental blows on the eye; and, inasmuch as some of the morbid states alluded to are occasionally found associated with conical cornea, it is requisite, in diagnosis, to determine the more probable source or sources of the phenomenon with that rigorous analysis which the difficulty of the inquiry suggests.

Strabismus, internal or external, has been spoken of by Dieffenbach, as now and then met with in cases of conical cornea.

I have met with internal strabismus in one case of conical cornea, of the second class, which came on as a consequence of ophthalmia, associated with an exanthematous attack, in a boy, 10 years of age; in this case the central and inner parts of the cornea were opaque, and the patient was blind, but sight was restored by making an artificial pupil in the outer part of the rim of the iris.

In this case of strabismus, nature, as it were, had anticipated art; as the internal squint might be regarded as a natural effort to bring the most transparent part of the cornea directly in front, thus to receive a greater amount of light; so that after the operation for artificial pupil on the outer side, the internal strabismus was a positive advantage, and had it not existed, its production might well have been attempted artificially, by dividing the external rectus muscle of the eye.

It is probable that a hydrocephalic state of the fœtus in utero might affect the structure and contents, as well as the position, of the eye-ball; but it is nevertheless doubtful whether the opinions of some German ophthalmologists respecting this mode of origin of conical cornea, in cases of intra-uterine hydrocephalus, be sufficiently established by observation.

I have often, and carefully, examined the figure as well as other characteristics of the eye, in the human embryo, as well as in that of several mammalia, at various periods, but have never met with an instance in which the cornea had a conical form; so that as far as my own observations have gone I should doubt whether at any period of intra-uterine existence the cornea of the fœtus in the normal state is conical, whatever its varying degrees of prominence may be. In connection with this matter, however, we must not forget that there is a little practical difficulty, inasmuch as the precise form of the living eye depends, in a great measure, on its vital conditions; so that the figure of this living and beautiful optical instrument is but imperfectly transferred to the organ which we examine postmortem.

In the study of conical cornea, we should advance considerably if any means of accurately determining the thickness of the living cornea could be hit upon, to say nothing of the difficulty in precisely ascertaining its condition with regard to tension.

Flarer and others have thought, that softening of the central part of the cornea, and distension of this tunic, from increased accumulation of aqueous humour, were essential to the formation of "cornea conica pellucida;" it may, however, be doubted whether either of these conditions be absolutely essential to the morbid change in question; for, without caring much at present for the aqueous humour, or its supposed varying quantities, it may be asked whether the cornea, which is supposed to undergo processes of softening and atrophy, for the formation of conical cornea, may not also be capable of undergoing processes of induration and hypertrophy; in either way the front of the eye might become conical; in the one case, the cone would be in great measure made up of the fluid of the agneous humour; in the other, it might mainly consist of the solid material Both these conditions have been of the cornea. observed and described by writers of repute, although it is not intended in this place to offer either of them as an illustration of what most commonly happens in cases of conical cornea.

In three cases observed by Riberi, conical cornea followed a slow keratitis, which, after long duration, disappeared without suppuration or ulceration of the cornea; this tunic, however, was thinned and weakened "by loss of cohesion, from interlamellar or interstitial absorption," and hence gradually yielded to the pressure of the humours from behind.

It would be interesting if we could satisfactorily determine by observation that two different, and, as it were, opposite processes of nutrition go on in the same cornea at different times, or in different stages of the progress of conical cornea. The opinion of Himly seems to have leaned towards this view; he thought that in many cases the central part of the cornea was at first softened, and hence yielded so as to be pressed forward in consequence of the action of the recti muscles; but that such pressure, through the medium of the aqueous humour, upon the cornea, afterwards led to the thickening of this tunic, so that softening and atrophy in the earlier stage might be followed by hypertrophy in the latter.

Some cases of conical cornea having occurred suddenly, or having been supposed to have occurred suddenly, it has been imagined, that a rupture of the membrane of the aqueous humour and of the posterior layer of the cornea, from the influence of violent cries or muscular exertion, and disturbed respiration, was, in such instances, the immediate cause of the affection; the anterior layers of the cornea being pushed forward by the same force which caused the breaking of the posterior. This view,

however, could not well be maintained, if we attend to what commonly happens in connection with the influences of force applied in the manner here supposed; for the anterior layer of the cornea in such circumstances would be the part put most on the stretch, while at the same time it is not supported by anything, if the strength of its own tissue be excepted; the posterior layer all the while is put less on the stretch, (wedging onwards, if we may be allowed the expression, towards the anterior, which is bent over it,) and also receives support from the front layer, behind which it is placed; so that if any rupture took place in the cornea as a consequence of pressure exerted from behind, it would seem that the anterior rather than the posterior layer should give way.

The opinion entertained by Adams and others, that, in cases of conical cornea, the prominent or conical part of the tunic is generally thickened, so as to present on the fore part of the eye a solid mass of living crystal, as it were, seems not to be sufficiently established by the results of pathological observation. If such a state of parts ever occurs, it probably belongs rather to the exception than to the general rule.

Fario and others have supposed, that in cases of conical cornea the tunic is first thickened by hypertrophy, and afterwards thinned by inflammatory action, tending to, or ending in ulceration; so that the latter stage of the disease, as noticed by this distinguished oculist of Italy, corresponds, as it were, to the whole course of the malady as viewed by Benedict, who says that this complaint is often produced by inflammation, which leads to ulceration of the centre of the cornea, whence that distension under the influences of which the cornea assumes the conical form.

A distinguished Parisian ophthalmologist does not seem to have been acquainted with the theory of Benedict; for when he published the same thing as new in France, it was already growing old in Germany: and allusion has also been made to this as an occasional, or exceptional, mode of origin of cases of conical cornea, by other writers on the subject.

Weakness and "paralysis" of the membrane of the aqueous humour, have been regarded by some as sources of conical cornea; and increase in the quantity of this humour, and at the same time deposit of serous and transparent fluid between the

lamellæ of the cornea, have been looked upon as pathological conditions associated with this disease; and the malady has also been attributed to an increased nutrition of the cornea, with or without irritation in the vascular system of the eye.

Before alluding to weakness and paralysis of the membrane of the aqueous humour, in any state of disease, it would have been well, had it been possible, to determine what its strength or action in the normal state may be. It seems probable that in some cases of conical cornea the morbid action may begin in the back part of the cornea, but the importance which, in the above-named view, is attached to the membrane of the aqueous humour, would seem to be relatively somewhat great.

Amongst the many opinions entertained respecting conical cornea, two are especially remarkable;

1. The opinion that the cornea is weakened and thinned, so that the aqueous humour encroaches upon it, and presses it forward;

2. The idea that the cornea is strengthened and thickened, in such manner that it might even be supposed to encroach on the aqueous humour, and press it backward.

If the cornea were thinned at the centre, a conical prominence of such centre would be likely, in most cases, to follow, the aqueous humour fully and evenly distending the chamber in which it is enclosed; but how the tunic should as regularly become conical by virtue of a process of thickening is not so easily understood, - to which the remark may be added, that the centre of the cornea, which may be regarded as farthest removed from the sources of nutrition, might, as far as this reason is concerned, be more likely to suffer from atrophy than from hypertrophy. These observations, however, should be regarded as more peculiarly applicable to those cases of cornea conica pellucida, which have not been preceded or accompanied by the ordinary phenomena of inflammation, inasmuch as it is obvious that they would not so well apply to many cases of opaque conical cornea, or ordinary staphyloma, in which remarkable thickening, as well as other alterations of the whole of the cornea, are frequently found to have taken place.

Again, this great hypertrophy of the cornea, without any diminution of transparency, is not so easily understood. But we do occasionally observe

remarkable thinning of the cornea by ulceration affecting its anterior surface, and that without loss of the diaphanous condition. It is not unworthy of notice that, in some cases of this kind, where the cornea is very much thinned, its weakened tunic is not thrust forward by the aqueous humour. In one case, which recently came under my notice, the cornea, towards the outer side, where it was thinned, presented anteriorly a somewhat regular and concave surface, which gave an inverted image of a small taper held before it.

In one case of conical cornea, the thin tunic was burst by a slight blow on the eye. Such illustrations, however, of the extreme tenuity of true conical cornea must be regarded as exceedingly rare; while the bursting of the eye, either spontaneously or accidentally, after previous and long continued distension and thinning, may more frequently occur in cases of hydrops oculi. Between these two diseases, however, there are many points of resemblance, which cannot fail to interest the pathologist and the practitioner; and it is evident that it would be no disadvantage either to staphyloma, conical cornea, or hydrops oculi, if they were studied

more side by side. In one case observed by Walther, a conical state of the cornea, along with an oval form at its margin, was observed in connection with hydrops oculi.

The facts which favour the idea that, in many cases of conical cornea, the affected tunic is thinned, are many and various; in one instance related by Flarer, the conicity of the cornea was gradually removed by the long-continued oozing away of the aqueous humour, which passed through a fistulous opening consequent on a simple para-Had the conical cornea centesis of the cornea. depended on thickening of this tunic, the disappearance of the conicity could scarcely have occurred in the manner just noticed; and the fact at the same time tends to show that, in such cases, if any means of lessening the quantity of the aqueous humour could be devised, an important remedial agent might thus be supplied; while it is obvious that a delicate paracentesis of the cornea might be practised, and repeated with some hope of doing good, either with or without the after employment of pressure. If the apex of the cone were at any considerable distance from the centre of the cornea, such apex might be

chosen as the site for the puncture; but if the apex were at, or very near to the centre of the cornea, which, as we know, is not unfrequent, then, of course, the point for paracentesis must not correspond with the point or transparent apex of the cone, lest the consequent opacity should be great enough to prevent the light traversing the part affected. If, however, such apex had become opaque, this caution would be less required.

Here it may not be unworthy of notice, that in cases of conical cornea treated by the formation of artificial pupil, for which the cornea is punctured near its margin, the patient has, at the same time, the benefit, it may be, of a paracentesis of the cornea, through which the aqueous humour may ooze for a little time, more especially if, within the aperture, the cornea has been rubbed a little by drawing a small portion of the iris into or through the opening previous to the removal of such portion with the scissors,—an act likely to interfere, more or less, with the immediate re-union of the cornea.

To previous observations relating to the operative surgery of conical cornea the following considerations may be added.

If it should appear desirable to practise paracentesis of the cornea, and, at the same time, to remove an extremely small portion of this tunic, at the point where the instrument is introduced, so as to secure a continued oozing out of the aqueous humour, for some little time afterwards, without the repeated application of instruments, which would be likely to produce too much irritation; it would seem, that, for this purpose, an instrument of very refined construction, but in principle resembling that employed for perforating the membrane of the tympanum, and at the same time securing a future opening at the point of perforation, by removing a very small portion of this membrane, might not be altogether unworthy of the attention of the oculist. When the cornea is punctured with an ordinary needle, the aqueous humour commonly runs out with sufficient readiness, so that any particular contrivance, such as the grooved needle, or the "aiguille à pompe," would not seem to be required when our object is merely to let out a small quantity of this fluid, especially as its consistence, or rather tenuity, is rarely found to have undergone any remarkable alteration.

In the case of Fario, mentioned at page 22, an oozing out of the aqueous humour for some days after each operation was one of the effects produced by excision of small portions of the cornea. A subsequent effect would probably be the formation of a firm and small cicatrix at the part whence the little triangle of cornea had been removed; so that the patient would first have the benefit of some degree of flattening of the cornea, from a diminution of the quantity of the aqueous humour, while, in the next place, the small cicatrices of the tunic, and their gradual contraction, might tend to prevent any reproduction or extension of the conical form.

Corresponding results, in other words, the gradual draining away, for a time, of a portion of the aqueous humour, and the subsequent formation of cicatrix, were obtained by Flarer, in another way. In the *Medical Gazette* of Milan, this distinguished Italian surgeon has reported a case of conical cornea, in which, with a fine needle, he passed a delicate seton of silk through the affected tunic; a proceeding which was followed by very favourable results.

It is obvious that a very nice discrimination must be required to enable us to select judiciously the cases which are suited to, or which are likely to be benefited by, operations such as these. In any case where the seton has been introduced, the greatest care should be taken not to allow it to produce too complete, or too long-continued, an evacuation of the aqueous humour; and it is evident, that we should be very careful not to permit it to remain too long in the eye, for, in this place, if such play with language were allowed, it would be very true to say, that the sight of the patient may hang on a very delicate thread; and it need scarcely be remarked, that the success of such an operation must depend mainly on the nice watching of the changes it induces, and on the associated measurement of its tendencies and effects.

Both the operations above noticed; or, the excision of portions of the cornea as practised by Fario, as well as the passing of a seton through this tunic, performed by Flarer,—seem to have been suggested by well-observed efforts of nature, in cases where ulceration, and subsequent firm cicatrization of the cornea, had been followed by the lessening

of its previously conical form; or where a small fistulous opening for some time existing had kept up a gradual drain on the aqueous humour, and had thus favoured the gradual lowering of the conically elevated cornea.

In operating for conical cornea, by removal of small portions of the tunic, after the manner of Fario, it is not difficult to imagine a case in which the operation might be more or less successful or unsuccessful, as the position of the part operated upon might be favourably or unfavourably placed, with regard to the effect to be produced by the subsequent cicatrization; thus the side of the cone next the temple might be relatively long and flat, while on the nasal aspect it might be shorter. If, in such an instance, one portion of cornea were excised, and this were taken from the temporal, the outer, or more flat side of the cone, and from the margin of the tunic, the effect produced would probably not be so good as it might have been had the excision been practised on the nasal side, where the contraction of cicatrix would have a better chance to tell upon the apex or highest part of the cone, which, being nearer to it, is, as it were, more within the reach of

the effect which a minute and contracting scar would be likely to produce.

The record of these Italian operations is both important and interesting, although it be quite obvious that they are not likely to be often repeated; the cases were peculiar or exceptional, the remedial measures not less so; and in connection with such facts, it may be remarked that in the therapeutics of conical cornea there are no general rules capable of being constantly or widely employed. Cases of this malady are so dissimilar, either as regards the state of the cornea, or that of some other part of the eye, to say nothing of the various morbid conditions of distant organs, now and then found to accompany the ocular affection, that a special plan of treatment must be devised for almost every case; and if this be true, it necessarily follows, that, in attempting to apply generally, or constantly, any method of treatment previously laid down, never mind how successful it may have been in the hands of others, the practitioner must not be surprised if he meet with frequent disappointment.

Hence, too, the great value of many practical observations relating to various modes of treatment,

and operative proceedings, employed for the relief of this affection, by eminent surgeons of Great Britain and Ireland; in the study of which we cannot fail to observe that the results of certain operations have, in practice, been more favourable than ordinary physiological views would have led us to suppose; so that even opinions based on the geometric form of the cornea and lens, and helped by the most careful consideration of the optical properties of these bodies, separately, or combined, have not always been in accordance with the results of operations, which have occasionally effected an improvement in vision, not predicted, nor accounted for, by theoretical considerations; all which, however, tends only to show that it is extremely difficult, in any individual instance, mentally to seize on all those sources of success or disappointment, which, in such matters, may be so delicately combined.

These observations are intended more especially to apply to cases of operation for the destruction, dislocation, or removal of the crystalline lens, which seem upon the whole to be very uninviting, and which are apparently condemned by theoretical views, but which, nevertheless, have in a few instances been practised with success, or, at any rate, with subsequent improvement of vision, by Adams, Butter, Walker, Vidal, &c.

When, in such cases, the cornea is divided, and the lens extracted, the benefit may be, in part, conferred by after flattening of the cornea, as would seem to have happened in the interesting case related by Mr. Walker, so that we might err in attributing an improvement of vision mainly to the removal of one refracting body, which is, in reality, in some measure due to alteration in the form of another.

In some cases of conical cornea in which the operation for artificial pupil has failed, other morbid conditions of the eye may have co-existed; disease of the retina, or of the vitreous humour, would be sufficient to prevent success; and this consideration, it is obvious, should not be lost sight of in our estimate of the value of such an operation, which is evidently good in some cases, but often likely to fail.

The cornea may be conical in cases where the conicity depends upon the thickening of an opaque centre; artificial pupil, in such cases, may be practised with success; the light afterwards entering the eye by way of an aperture in the rim of the iris, having previously traversed the outer and transparent part of the cornea; but, in such instances, it might be said, that the treatment is adapted rather to opacity than conicity of the cornea; and here we may observe, that there is some reason to believe that differences in the results of treatment of cases of conical cornea would be better understood, if the application of terms in this matter were more rigorously attended to.

A single instance of success from the formation of artificial pupil, in cases of true conical cornea, would be sufficient to suggest that the operation is not to be altogether rejected; and such have been recorded by Mr. Tyrrel, Mr. Wilde, and others; while the failure of the same proceeding, in some cases, shows clearly the great importance of a refined diagnosis, and of adequate attention to concomitant circumstances.

It is worthy of remark, that with some practitioners the formation of artificial pupil has been followed by favourable results in two, three, or even more cases in succession; while others, in an equal number of operations, have not had one case of happy termination. Such a disparity of results might be

accounted for in various ways, which need not be dwelt upon here; but one important consideration must ever be borne in mind, we allude to what may he called the question of time; for, to be able to form an adequate appreciation of the effects of any surgical operation, these should be considered, in many instances, not a week, nor a month, but, at least, twelve months, after it has been practised. then, the patient give a good account of his condition as improved by operation, the benefit may be regarded as certain; but amid the industrious classes of the community, whose cases are more frequently reported than others, the frequent change of abode, as well as other circumstances not less important, render an accurate knowledge of ultimate results nearly impossible in a great number of instances.

In any case, therefore, where, at first, a good effect seems to have been produced by operation, or other plan of treatment, the patient should be seen occasionally for a few months, and afterwards a complete report drawn up, containing the details of an impartial and frequently repeated observation. With less than this, the accurate observer or cautious practitioner can never be completely satisfied; it must

nevertheless be admitted, that, however easily these remarks may flow from the inkstand, it is very difficult to apply them in practice.

In connection with the operative treatment of conical cornea, the very interesting case of Mr. Gervis requires to be mentioned.

The patient was a young woman, 25 years of age; "the cornea, as usual in such cases, was prolonged, not opaque, presenting an appearance as if a crystal projected from its centre, which, by the refraction of the rays of light, deprived her of sight, except in a modified degree, when looking at objects in a lateral direction, and then most imperfectly."

Mr. Gervis says, "with a view of breaking up the laminæ of the projecting cornea, and to promote absorption of what I considered its thickened structure, or hypertrophy, I punctured it several times with a couching needle, and about three times a week applied to the conical centre the argent nit., making a sweep across it; the puncturing with the needle produced some opacity of the globular-shaped projection, just as is seen after severe inflammation of the cornea. I then applied the ungt. hydrarg. nit. oxyd. daily, to the eyelid, with marked success;

and by perseverance with these combined means I completely succeeded, within three months, in gaining my object, the restoration of her sight; and the cornea assumed its normal appearance. I have seen the young woman since the cure was completed; she continues perfectly well, and has returned to her employment without the least injury to her sight."

The patient at first had a blister to the temple; she took large doses of carbonate of iron, and the compound galbanum pill, with port wine, and a generous diet.

With regard to the more especially surgical part of the case, I have thought it best to quote the words of Mr. Gervis, as the method of puncturing the cornea which he resorted to was peculiar, if not unique, inasmuch as this puncturing was confined to the texture or substance of the cornea, and "never went so deep as to reach the aqueous humour."

By such application of the couching needle Mr. Gervis would be able to judge of the thickness of the affected part of the cornea, as he passed the point of the needle into this part; and as he distinctly speaks of its thickened structure, or hypertrophy, we must regard this case as an illustration

of conical and transparent cornea, with thickening of the conical part, this part having become more or less opaque, from the employment of the needle, but recovering its transparency in the after course of treatment.

In a second "case of conical cornea, with opacity," Mr. G. "resorted to similar treatment, and with success."

In the Report of Mr. Gervis, the observations relating to the employment of nitrate of silver are very significant, where he says, "it acts as a direct stimulant to the absorbents, increasing their power of action to take up the *thickened structure* of the anterior laminæ of the cornea," where the *thickened* state of the cornea, as well as the potency of the nitrate of silver, is obviously recognised.

In such cases it might not be amiss to employ a feeble solution of the salt of silver, during a few days, and then gradually increase the strength of this, before the solid nitrate is applied; as this caustic, when applied to the eye, or eyelids, in some constitutions, produces a very great amount of irritation and re-action.

Taking the view of Mr. Gervis, we should be

disposed to employ it cautiously, in those cases of conical cornea which seem to have been associated with over-exertion of the eye, or with some particular mode of using it; here we may mention, by way of illustration, the case of conical cornea in the right eye of a sportsman, (W. W. Cooper,) the eye which he solely employed in levelling his fowling-piece, without entering upon the question of cause and effect, or that of coincidence, which might here be suggested; or inquiring whether by any contractile or elastic structure, connected with the cornea, or with any other part of the organ of vision, there may, or may not be, any change in the form of the anterior part of the eye at the time the organ is intently employed, as in the act of taking aim.

But few writers on hyperkeratosis have spoken positively respecting the thickened state of the cornea; amongst these, Juengken and Rosas may be cited; while Radius, Himly, Ammon, and Schön, are not forgotten. Juengken and Rosas mention the increased thickness of the tunic, in such terms as shew that they entertained no doubt respecting it, without, however, alluding to any autopsy. The

observations of the late Mr. Walker, and of Mr. Middlemore, may be placed side by side with the cases given above; the interesting contrast tending to shew, that additions to our knowledge of the subject derived from post-mortem examinations are much to be desired.

A case of conical cornea occurred in the practice of Mr. Windsor, of Manchester, in which, after death, "the cornea generally was found very much thinner than natural, and in the centre especially so." The autopsy was made by Mr. Walker, and is noticed in his "Oculist's Vade-Mecum."

At page 532 of the first volume of Mr. Middle-more's treatise, we find the following as part of a note:—

"I have had one opportunity of examining after death the state of the cornea, in a person who was affected with conical cornea in an extreme degree, and in that instance its laminæ were less moveable upon each other, its circumference was of a natural and ordinary degree of thickness, but its apex was much thinner than usual, and rendered opaque on its exterior only, for its neural surface, even at the apex, was perfectly transparent; in other respects it did

not appear to have undergone any change, unless I mention that alteration in the evenness and equality of its surface discovered by Dr. Brewster, but which was not visible to the naked eye."

The fact alluded to by Mr. Middlemore, of the laminæ of the cornea being "less moveable upon each other" than in the normal condition, has not hitherto been dwelt upon by other pathologists; indirectly it reminds us of a curious remark of Juengken, who describes small nebulous spots as seen on the middle of conical cornea, or about the apex of the cone, such as are often met with as consequences of scrofulous ophthalmia, but which, he says, have this peculiarity, that they now and then change their place, and even disappear altogether, and return after a while.

Supposing this phenomenon to have been well observed, it is certainly not easy to account for it in a satisfactory manner; for if the same opaque or nebulous spots appear, then disappear, and after a while become visible again, we are, of course, curious to know what, and where, they are; and being willing to imagine that they are not generally entozoa, or other opaque forms floating about in the

aqueous humour, we must endeavour to think that they belong to the cornea, and that they move between its laminæ; and this, it must be admitted, would, for most cases, be somewhat difficult; whether the opaque spots might consist of lymph, the product of keratitis, or of some other matter, we need not stop to enquire; and it need scarcely be mentioned, that the minute spots which present themselves in cases of corneitis punctata, some to vanish altogether, others to leave traces of their previous existence behind them, should be guarded against as a possible source of error in this kind of observation; while cataracta punctata, along with synchisis, and moveable lens, seems sufficiently away from any chance of troubling the diagnosis.

In the horse, the mule, the ox, the pig, and the dog, entozoa have been found in the eye; in these animals, more especially the former three, the filaria papillosa is sometimes the cause of ophthalmia, while in the mule, dog, and pig, the cysticereus cellulosæ has been more frequently met with; it would not seem, however, that any conical alteration of the cornea has hitherto been observed in connection with, or as a consequence of, the presence of any entozoon

within the organ of vision of the animals above mentioned; carefully made observations relating to this matter would be worthy of record; as inflammation of the eye caused by the presence of a parasite, or its products, within this organ, would not be unlikely to increase the quantity of the aqueous humour, and thus to alter the form of the cornea, if not to soften or otherwise change its structure.

The internal or deeper complications of conical cornea, or those affections of the aqueous humour, lens, vitreous humour, retina, or other part, which may exist in connection with altered form of the anterior tunic of the eye, should always be very carefully studied; and if one of the German eye specula, or one of the recent improvements upon the instrument of Helmholz, such as the ophthalmoscope of Follin and Nachet, be brought to bear upon the investigation, the diagnosis may receive a more satisfactory finish, as, with their aid, the condition of the retina, as well as that of the refracting media of the visual organ, may be more completely determined, provided the eye has not been previously disturbed by depression or removal of the lens.

Rosas gives an interesting definition of conical cornea. He says, that cornea conica is a disease in which the cornea, without any adhesion with the iris, projects in the form of a cone, and is, at the same time thicker than natural; the cornea being, in some cases, transparent, and without any degeneration of structure, while, in others, having undergone morbid change in texture, it is found to be opaque.

He further states, that the disease is scarcely ever preceded by inflammation, mentions polyopia as one of its symptoms, regards compression of the eye, as recommended by Demours, as useless; and says that by avoiding painful or fatiguing employment of the eyes, and by exercising vision on distant objects, the progress of the affection may be retarded.

There is no doubt that in cases of conical cornea, repose of the affected organ should be recommended; but, in many instances, its exercise upon distant objects would be found difficult and fatiguing; in this place, however, we may regard the word distant as a relative expression, and, at the same time, venture to suggest, that the attempt should, in favourable cases, be made, gradually, to increase the distance at which objects are viewed, so as,

if possible, to help the eye in its adaptation under abnormal conditions; and for this purpose a little mechanical contrivance may not be altogether unworthy of notice.

When the shortest distance at which a near object, such, for instance, as large letters, can be seen, is determined, the head being steadily supported, and the book at rest, either one or the other may be moved, so as to increase the distance of the letters, by a few lines, the quarter, or the half, of an inch, and as a very gradual and well-regulated widening of the distance should be secured, it is well to rest the head upon an apparatus, provided with a screw, so adapted as to be able by a slight turn to widen the space between the eye and the book, and thus, by very slow degrees, try, if possible, to increase the range of vision.

It is evident that this suggestion only applies to the less serious forms of alteration in the cornea, or to such as are characterized by symptoms more or less like those of ordinary myopia; for the relief of which Berthold contrived the instrument to which he has given the name of "Myopodiorthoticon," and of the results of which he speaks so favourably; this is simply an apparatus for supporting a book below, and the head above, with screws for increasing or diminishing the distance of the two, and hence of the eye from the object looked at, and a scale for noting the various distances employed.

In cases of myopia in the young, I have more than once found great improvement to take place, by regulating the employment of the eyes, and gradually increasing the range of vision.

Rosas remarks, that in cases of conical cornea the broiement of the crystalline lens improves the vision, but without altering the form of the cornea; and here it may perhaps be well to observe, that in connection with most of the cases of conical cornea that have been reported as improved by operations on the crystalline lens, very minute details have not been published; where the lens was cataractous, it may have been sufficient to speak of its opacity; but where its transparency was apparently undisturbed, it might have been a matter of some interest at the time of the operation, to have noted, as nearly as possible, its exact position, which would be indicated by the part at which the needle would meet with resistance in commencing the

breaking up or dislocation of the lenticular body; for, if any abnormal and forward prominence of the lens, or of the anterior part of its capsule, prevailed, the disturbance of vision associated with conical cornea might be considerably increased; and in this place the words of Ulrich, relating to this kind of alteration, as connected with the first stage of dropsy of the capsule of the lens, seem worthy of quotation, where, alluding to the various causes of myopia, he thus gives one:—

"In primo phacohydropsiæ stadio, quo capsulæ lentis paries anterior nimia sanguinis seri exudatione magis antrorsum proeminet."

We will not here dwell upon the difficulty of diagnosis, which must prevail, with regard to an affection of so recondite a character.

It is not improbable, that in some cases, where the formation of artificial pupil seems desirable, that a portion of the iris, on both sides of the pupil, might be removed with advantage; to operate at the same time for double artificial pupil by the removal of one portion of the iris above, and of another below the pupillary aperture, would not be so likely to answer, unless in some exceptional case,

or where the aperture of the eyelids might be wider than usual. Before this, or any other surgical operation, is practised on the eye, in cases of conical cornea, the organ should not only be carefully inspected, but also delicately examined by the touch, whenever the state of its sensibility will permit this mode of extending our observation; and here we may remark that some writers on conical cornea have spoken of diminished sensibility of the affected tunic, as one of the characteristics of the malady in question; and Textor mentions a case of conical cornea in which the conical part of the tunic was very prominent and thin, and within which he distinctly felt the fluctuation of the aqueous humour; but for the patient to bear a digital examination of the cornea, sufficient to allow a fluctuation of this humour to be distinctly felt by the finger of the surgeon, must generally be somewhat difficult.

Many curious facts tend to shew how profitably art may imitate or follow nature in the treatment of some cases of conical cornea; this is sometimes observed in connection with the results of morbid processes of spontaneous origin, at others it may be seen along with the effects of accidental injury to the eye. Ulceration, and fistula of the cornea, and their occasional consequences, supply illustrations of the first class; accidents, such as the following, related by Mr. Estlin of Bristol, and quoted by Mr. W. White Cooper belong to the second. Mr. E. says, "One case occurred to me, where the lens of an eye with conical cornea was wounded by a needle, which ruptured the capsule and produced a cataract, which became absorbed by the effect of the accident which occasioned it. The loss of the lens improved the power of seeing." The practical application of such observations of the "vis medicatrix nature," in circumstances corresponding to some of those here alluded to, has been in some measure illustrated in the foregoing pages.

The study of the embryo, fætal, or congenital forms of conical cornea has hitherto been very limited, and the few facts relating to this part of the subject are mainly derived from the zeal of German observers. Mr. W. W. Cooper says, "Mr. Wilde is of opinion, that when this conformation is congenital, the axis of the cone is seldom in the middle of the cornea, but is either above, below the centre, or to one side;" to which it might be added, that the centre

of the cone, in cases of conical cornea, seldom corresponds precisely to what Arlt has called the "mathematical centre" of the cornea, but that in the cases of embryo, or congenital conicity of the cornea, hitherto observed, the inclination of the cone towards any part of the circumference of the cornea has but rarely been the subject of especial observation, so that a greater number of facts in this department would add to the interest of any view relating to the eccentric position of the apex of the cone, in any particular class of cases.

Ammon speaks of the eyes of a fœtus of two months, in which the corneæ were at all points of the same thickness, but prominent, and conical, so that the case was regarded as one of conical cornea; while, with the exception of the so-called conical cornea, the eyes were in normal condition.

In two other cases of conical cornea, mentioned by the same writer, the corneæ, on post-mortem examination, were found of equal thickness throughout.

In the cases of congenital conicity of the cornea hitherto observed, it would not seem that any remarkable alteration in the thickness of this tunic has been met with; a fact which, if confirmed by further observation, would perhaps suggest the idea, that cases of this affection, occurring in utero, are often to be regarded, rather as instances of malformation of the cornea, than as products of any disease of this part occurring in the embryo or fætal state; but inasmuch as malformation of the cornea might, doubtless, be a result of disease, as even an arrest of development might follow the occurrence of morbid action in the part, the distinction above alluded to must be regarded as one which can rarely be determined in a satisfactory manner.

Of late years, cases of conical cornea have been described, in which the conical elevation affected only a part of the tunic, the base of the cone being smaller than that of the cornea itself; but earlier writers on conical cornea defined this disease as consisting in conical form of the part, the margin of the base of the cone coinciding with the margin or periphery of the cornea; the transparency of the latter remaining unaltered.

If, in more recent times, it had been thought requisite that cases of conical cornea should correspond to this kind of definition, their number would

have been materially lessened; but when the disease is regarded as one which may affect either a part or the whole of the cornea, and in which this tunic may be perfectly transparent, or may be more or less marked by opacity, that which we may call the numerical range of the malady, is, at once, very much extended, while, at the same time, it is obvious, that, if one writer take the former, and another the latter view of what a case of conical cornea is, or should be, the management of the disease, as viewed and treated by such observers, will betray much discrepancy in its results; and the necessity for such remark is sufficiently apparent if we bear in mind the fact, that, while some of the earlier observers speak of conical cornea as a disease in which the cornea retains its transparency, amongst recent writers, some are to be found who declare, that this tunic is always more or less opaque, when in cases of hyperkeratosis it has assumed the conical form; these two modes of viewing conical cornea have evidently been, in great measure, the source of some of the great differences of opinion which have prevailed with regard to the effects of curative treatment applied to it; for, while it is quite true

that cases of conical cornea do occur without any marked phenomena of keratitis, or other form of ophthalmia, having been previously observed, and in which, for a long time, there may be no loss of transparency in the corneal tunic; other cases are met with in practice, which are evidently the results of well marked, and often long continued inflammatory action, and in these, opacity of the cornea to a greater or less extent may be found to exist; in the first class of cases the whole of the cornea is commonly occupied by the cone, although exceptions may occur; in the second, the conical elevation not unfrequently rises upon a part of the cornea, while the curve of the remainder of the tunic is not perceptibly altered in its form; and if further subdivision were allowable, it may be remarked, that cases of the first class, in which no loss of transparency is commonly observed, are now and then found to pass over, as it were, to the other group; the cornea, in such instances, may have been conical, yet perfectly transparent, for a considerable time, irritation of the eye, with pain, lachrymation, and photophobia, come on, and, afterwards, gradually subsiding, leave opacity of the cornea behind; while

the various causes of such change need not be dwelt upon here; this alteration, however, from the transparent to the opaque condition, has been spoken of by some as now and then occurring without any appearance of inflammation: thus Ware remarks, that "a small speck sometimes forms on the centre of this tunic, without any previous inflammation, in those peculiar cases in which the cornea undergoes a change from its round figure, and assumes a conical or sugar-loaf shape."

In some cases of conical cornea the anterior surface of the affected tunic is more or less deprived of its smoothness, little foveæ or depressions, varying in number, from one or two, to half a dozen or more, are now and then observed, and may be better seen with the aid of the lens; these, in most cases, seem to be results of ulceration, the remainder of the cornea having its normal aspect, as far as surface and smoothness are concerned.

In other cases, the surface is irregular as a whole, and when viewed with a high magnifying power looks rougher than the corresponding part of a sound eye; while vestiges of ulceration cannot generally be satisfactorily observed. These conditions, however, of the corneal surface are by no means peculiar to conical cornea, for they are occasionally observed as results of morbid action, in cases where this tunic has not assumed a conical form.

Amongst the various constitutional, general, or nervous affections, that have been observed in connection with conical cornea, hysteria is perhaps worthy of more attention than it has hitherto received; increased accumulation of the aqueous humour, or hydrops oculi, with alteration in the form of the cornea, has been observed along with severe cases of hysteria, and amongst the records which relate to such observations those of Dr. Bruck have both interest and value, as the three remarkable cases, related in Ammon's periodical, may show; which, although not given in connection with conical cornea, are not far from analogies that belong to it.

There is not, perhaps, any other disease of the organ of vision, which a careful observer would be likely to mistake for conical cornea; in a case of dropsy of the anterior chamber, a little extra caution with regard to diagnosis might be requisite; but in such instances the anterior part of the eye has commonly an appearance of remarkable ro-

tundity, reminding us of the expression, "cornea globosa," rather than of that of "cornea conica," and, at the same time, that sparkling and brilliant aspect of the eye, so often met with in cases of conical cornea, is generally wanting in those of hydrops oculi; to which it may be added that the diameter of the sclerotic margin of the cornea is often increased along with the general enlargement of the tunic in cases of hydrops oculi; a state of things rarely to be observed in connection with conical cornea.

In some rare cases, where suppuration and ulceration have affected the posterior surface of the cornea, and have thus weakened it as a whole, the anterior and yet transparent lamina may project forward, and may assume more or less of the conical shape; this form of disease, if called conical cornea, should be qualified by the expression, consecutive, or, at any rate, distinguished from cases that are not preceded by the ordinary phenomena of inflammation, as well as from those that follow conjunctival ophthalmia, or affections of the anterior part of the cornea.

Conical eye-ball is occasionally met with; in which the sclerotic tunic appears lengthened or prolonged anteriorly; its shape, in some measure, resembling that of the wider part of a funnel, on the smaller or anterior extremity of which the cornea is, as it were, fitted; the appearance of the eye in these cases might be compared to that observed in the organ of vision of raptorial birds; but the form alluded to, as observed in the human being, is generally a consequence of chronic inflammation, frequently of syphilitic character; in such cases vision is generally destroyed, and the appearance of the malady has nothing which we could regard as very similar to conical cornea.

The eye, in cases of conical cornea, when looked at in front, has often a bright, but, as it were, watery, and, hence, deceptive appearance, mainly from the optical effect of the prominent, transparent, and conical tunic; this appearance, if but slightly noticed, might be mistaken for lachrymation, and thus its real cause, and the true nature of the complaint, overlooked; so that while it is not easy to mistake any other malady for conical cornea, it is not so difficult to overlook conical cornea, thinking some other affection, and that alone, to be present.

The following is a remarkable case of conical

eye-ball, and seems worthy of notice in this place, helping, as it does, to illustrate some of the points of difference between conical cornea, and conical eye-ball.

P. C., æt. 24, a strong young man, with grey iris, got syphilis nine months ago, for which, during two months, he had no medical treatment.

Four months ago, he had iritis on the right side, and one month ago, the same complaint on the left side; the left sclerotic seeming to suffer much at the same time; this tunic, the left sclerotic, appears now to have been thinned at its anterior part, and, as it were, stretched forward, so as to have lifted onward, or forward, the cornea connected with it; hence, at present, the eye, in figure, might be compared to an egg, one end of which is relatively very small, with the cornea fitted as a sort of dome upon this small end, the cornea all the while preserving its normal form; it is very remarkable that, as nearly as could be ascertained by careful measurement, the most anterior part of the cornea in the eye affected, is half an inch in advance of the corresponding part on the opposite side. The patient sees the light, but cannot distinguish any object; the iris is pushed

forward, so as to be rounded on the fore part; the pupil is irregular, and fixed, the cornea somewhat hazy. When the eye is closed, the lids seem much on the stretch; when opened, a great portion of sclerotica is seen, presenting an appearance very different from what is commonly observed in cases of conical cornea.

The diagnosis of some diseases of the eye may be facilitated by the study of good drawings, which represent them; and many works, both English and Foreign, on ocular maladies, contain representations of conical cornea, which give an accurate idea of the form of the cornea, when seen sideways; but that peculiar and brilliant appearance of the front of the eye, which is often met with in cases of true conical cornea, is somewhat beyond the reach of the art of the draftsman; inasmuch as the difficulty here to be overcome by the pencil is not unlike that which would be encountered in attempting the pictorial representation of the diamond; nevertheless a facsimile of conical cornea may be produced in the artificial eye, the general resemblance of which to the diseased condition of the living organ is peculiarly striking.

The lamented Dalrymple has shown how much can be done in the pictorial representation of morbid conditions of the eye; and the beautiful "Iconographie" of M. Sichel, now in course of publication, and with improvements upon former sketches of the cornea, seems destined to place England and France side by side, and unrivalled, in this department of art.

In the attentive observation of the artificial eye, I have more than once noticed, that the glancing, brilliant appearance, often characteristic of conical cornea, is seen on the artificial piece, if the curve of the part representing the cornea should happen to be irregular, or the surface itself such as approaches the polyhedral form; besides which, it may be remarked, that the slightest approach to the form of conical cornea, in the artificial eye, is sufficient to betray the non-natural character of the part, by a peculiar glancing appearance, not seen in the opposite organ, and which, in some instances, is the first source of the discovery that a person has really availed himself of the aid of ocular prothesis.

If a simple and perfectly transparent cone of

glass be fashioned in imitation of pellucid and conical cornea, it may be held before the healthy eye, when objects looked at are confused, and cannot be distinguished; and the confusion and indistinctness are rendered greater if a bi-concave lens be held before the transparent cone; but if, instead of this, a bi-convex lens be held in front of the cone of glass, objects again become visible; and the effect, as far as I have observed, is not materially altered by introducing, within the cone of glass, a transparent piece, to represent the crystal-line lens.

Side by side with this fact, it may be mentioned that Dr. Hull, in his work on the "Morbid Eye," says, in allusion to conical cornea,—

"In as bad a case as I ever saw, I have known most benefit received through an instrument made by a Mr. Abraham, an optician, in Bartlett Street, Bath. It is formed of two lenses, with an adjustment. The farthest and largest lens is convex. The lens near the eye is smaller, and doubly concave."

This instrument may be modified by an additional concave lens, of small size, and fitted in an opaque circle, wide enough to act as a diaphragm; the apparatus mounted in this way is made by Mr. Abraham, of Liverpool.

For the purposes of the ophthalmologist, it is obvious that a variety of lenses must occasionally be tried, so that the frame should be so constructed as to allow of their removal and change.

In the instruments I have seen, the adaptation of the convex lens is effected by means of a spring slide, passed into a hole, at one, or both ends of the spectacle frame, outside, but near to the hinge joint; if one eye only is affected, the corresponding side of the spectacles is fitted with the two lenses; if both eyes suffer, lenses, and combinations of lenses, should be very patiently tried for both, in different distances, positions, and inclinations, and the frame fitted up accordingly. It has appeared to me, that a very delicate rack movement might be employed, instead of the slides, with the aid of which the patient would command a smoother and more precise adjustment. With many patients, the first trial with this sort of instrument will be likely to fail; for the eye becomes fatigued before the desired combination is hit upon; but by trials repeated at

suitable intervals, varied, and patiently sat down to, in some instances good will be done.

Neither transplantation nor glazing of the cornea seems to have been seriously thought of in this country, as ever likely to repay the trouble and suffering associated with their performance; if such operations were really capable of supplying a transparent front to the eye, devoid of annoyance, and of which the patient could avail himself in vision, their repetition would, doubtless, be desirable, and cases of conical cornea, accompanied by opacity, might occasionally lend themselves to the attempt; but with regard to results of practice in this department of art, the expectations of surgeons are not yet likely to be very sanguine.

Transplantation, as recommended by Himly, has been essayed in Germany, France, America, and other countries, and has everywhere failed in restoring sight to the blind.

It is true that a piece of the human cornea, when opaque, may be cut off; and a piece of corresponding size taken from the healthy cornea of a dog, pig, or other animal, with an apparently suitable eye, may be put on, as a substitute, and united by

two or more sutures, and union of the adjusted parts may follow, and for a few days the engrafted piece of cornea may retain more or less of its transparency, but, in most cases, this is afterwards lost; sometimes with, sometimes without, shrivelling of the part. The accidents associated with imperfect union, or with total failure of union, and suppuration of the eye, need not be further alluded to here: these, however, are by no means unfrequent, as, by experimental inquiry in animals, I have more than once found.

I have taken the liberty of employing the expression of "glazing the cornea," for the operation proposed by Nussbaum, and which he has practised upon rabbits, and with results which he seems to regard as worthy of the attention of ophthalmologists.

A sort of glass button is prepared, with two little off-sets, or folds, to enable it to hold on, and be steady in the cornea; a short transverse incision is made in the cornea, and the glass piece, as it were, buttoned in; and that this can be done without any after and long-continued irritation of the eye, the bit of glass remaining fixed and steady, is proved, as Nussbaum says, by his living rabbits

which wear it; while he further remarks, that the appearance of the thing is by no means bad.

"Dass Ansehen eines also bewaffneten Auges is kein besonderes hässliches."

With respect to such a matter, however, tastes may vary.

If the foreign body, employed in the manner described by Nussbaum, can be worn with impunity, and even without apparent annoyance, the fact is certainly interesting, and the curious in researches of this kind might perhaps be disposed to repeat his inquiries; but we feel satisfied that, in the human subject, the glazing of the cornea would not be tolerated; so that it need not here be proposed as a remedial agent in cases of conical, or conical and opaque cornea.

Causes that act on the anterior surface of the cornea seem now and then to alter the form of this tunic by thickening it, while those that influence its posterior aspect, in the first place, occasionally change its figure, by pushing a part, or the whole of it, forward; illustrations of this truth are now and then met with in practice, and the following may be shortly noticed.

R. F., a young man of 18, has had trichiasis and entropion of the lower lids during the last six years, which followed an attack of ophthalmia brought on by frequent wetting of the feet.

In the left eye, which was more affected than the right, the entropion has been removed, by division of the orbicularis muscle; and the malady on the opposite side has yielded to treatment without the employment of the knife, and hence by the removal of the palpebral irritation, the morbid condition of the eye is lessened, and the vision considerably improved, but the corneæ are thickened, more especially in the middle, (from the effects of the long - continued inflammatory action, produced by the tarsal margins and ciliæ,) and hence present a marked conical form, which is easily seen in lateral view; this, as well as the next case of alteration in the form of the cornea, from a cause acting in front, may be contrasted with the case, next but one, where the morbid agency which affected the figure of this tunic evidently operated behind it.

One of the most remarkable cases of conical cornea, from injury, which has come under my observation was that of a miner, æt. 33, from the

neigbourhood of Wigan, who lost the sight of both eyes from an accidental injury, about three years before I saw him; in blasting stone, some portions, in flying off, struck his face; both eyes were injured, and afterwards became, the one sunk and flattened, the other prominent and conical, from hypertrophy of the corneal tissue, which looked as if an additional layer, of new and opaque growth, had been placed upon the central part of the cornea. Total blindness prevailed.

Morbid conditions of the posterior surface of the cornea are not necessarily associated with the occurrence of any conicity, or even of any forward prominence of the tunic, for, in cases of tuberculosis of the membrane of Decemet, we may occasionally watch the progress of the affection up to the effusion of a crescent of purulent matter in the space between the lower part of the cornea and the corresponding portion of the iris, without any bulging forward of the transparent front of the eye; it should, however, be borne in mind, that this is not the case in every instance, inasmuch as a thinning, weakening, and bulging of the cornea may be a consequence of ulceration and suppuration occurring at its back part, which, in some instances, leads to conical prominence

of the whole, or of a part, of the corneal tunic; but this state of things, as previously remarked, should not be regarded as belonging to that disease to which the name conical cornea is more especially applied; besides which, in cases such as those here alluded to, conicity, or even prominence of the cornea, is rather the exception than the rule; for while the degeneration at the back part of the cornea is in progress, some degree of flattening of the front of the eye not unfrequently takes place, a remarkable illustration of which has recently come under my observation. In the following case the alteration in the form of the cornea evidently depended upon causes operating behind it.

Mrs. M., æt. 60, had very good sight until about the age of 53, when the right eye became "weak," and two years later, after an attack of influenza, was found to suffer from cataract, and at the time when cataract was discovered in the organ of the right side, the left was free from any visible opacity of the lenticular apparatus, but its vision, although clear and distinct, was peculiarly short; and it was not until eighteen months afterwards that opacity of the lens occurred in the left eye.

The patient first discovered her shortness of sight with the left eye when in church, by finding that she could not see a person across the aisle in an opposite pew, while those in the pew joining her own were distinctly seen; and at this time she found that she could read without spectacles the very smallest of type, and could clearly discern minute objects, which, during the former and healthy state of her vision, she was unable to perceive.

At this time her medical attendant observed, that the cornea on the left side was peculiarly prominent, evidently more so than that of the right; and it is not less worthy of remark, that this prominence of the cornea gradually increased, and as gradually the myopia became more extreme. Somewhat remarkable as it may seem, it is stated, as the result of most careful observation, that the prominence of the cornea in this case was subject to variation, the extremes of which, in elevation or depression, were seen by the naked eye, and accompanied by corresponding alterations in the myopia. I found both the cataracts hard, at the time of the operation by which sight was restored.

In the myopia which occasionally precedes the

occurrence of cataract, visible alteration in the form of the cornea is commonly absent; the case just stated may be regarded as an extreme form of this affection, which has been attributed to diminution of the volume of the vitreous humour, and consequent projection of the cornea from the action of the recti muscles, pressing upon the hinder and less distended part of the eye-ball; also to increase in the density of the crystalline lens, and might possibly be associated with slight alteration in the volume of the eye-ball as a whole, or with the effects produced upon the eye by the habitual use of lenses, or by new modes of using the organ which its modified vision had brought into practice.

It seems especially worthy of remark, that in this instance, the myopia could be accounted for by a physical condition clearly seen by the naked eye; and, inasmuch as the state of the cornea sufficiently explained the shortness of sight, any possible change in the structure of the lens did not require to be taken much into account when the causes of the affection were considered; in addition to which it may be remarked, that at the time when this myopia occurred in the left eye, there was not the slightest visible opacity of any part of the lens through which vision was exercised, and the patient herself spoke of the remarkable clearness of her sight, at this time, in very strong terms.

There was no cough, or other morbid condition of the apparatus of breathing, or circulation, likely to disturb or alter the organ of vision; the influences of which, in connection with prominent and conical cornea, are worthy of attention.

A study of the mode of occurrence of such a change in the cornea, seems to lead to some interesting considerations not unconnected with the subject of hyper-keratosis; for it is probable that some alteration in the nutrition of the ocular humours was the cause of the change in figure which, in this case, the cornea assumed, and it is not difficult to imagine that, in a case of conical cornea, the first alteration of this tunic might be in its bend, or in the form of its curve, only, while it might afterwards undergo some change in density, or thickness, more especially at the centre, not so much at first, perhaps, from being put on the stretch, as from the subsequent effect produced on its nutrition by the physical alteration which it had undergone; while the next question in the progress

of inquiry seems to relate to the condition of the vascular and nervous system of the eye in which such changes have taken place; and of this inquiry, that part which belongs to the nerves that preside over the nutrition of the eye-ball is perhaps the most important; a remark which leads us to the additional observation, that the fifth pair, and sympathetic, have an especial claim on our attention in connection with this interesting subject.

Dr. Pickford's opinion respecting the mode of origin of conical cornea is thus expressed:

"I believe conical cornea to depend upon some disturbance in the function of the great sympathetic, spinal nerves, and par vagum; producing, through the medium of the lenticular ganglion and fifth pair of nerves, faulty action of the nutrient capillaries and absorbent vessels of the cornea itself;"— and in the valuable "Manual of Physiology," of Kirkes and Paget, we have the following anatomical observation closely connected with this matter:

"The existence of ganglia of the sympathetic in connection with all the principal divisions of the fifth nerve, where it gives off those branches which supply the organs of special sense; for example, the connection of the ophthalmic ganglion with the ophthalmic nerve at the origin of the ciliary nerves; of the sphenopalatine ganglion with the superior maxillary division, where it gives its branches to the nose and palate; of the otic ganglion with the inferior maxillary, near the giving off of filaments to the internal ear; and of the submaxillary ganglion with the lingual branch of the fifth;—all these connections suggest that a peculiar and probably conjoint influence of the sympathetic and fifth nerves is exercised in the nutrition of the organs of the special senses; and the results of experiment and disease confirm this, by showing that the nutrition of the organs may be impaired in consequence of impairment of the power of either of the nerves."

The results of the experiments of Hannover upon the cervical ganglia of the sympathetic, which have been already noticed, seem favourable to the views above expressed, while the observations made by Budge in his more recent experimental inquiry have an opposite tendency; this distinguished physiologist removed the superior cervical ganglion of the sympathetic, from both sides of the neck, in a female rabbit, on the 24th February, 1853; the animal soon recovered from the operation, without any apparent defect of nutrition, and, in the following June, brought forth six young ones, which she suckled and reared quite well; so that the removal of the ganglion in question seemed not to have affected the nutrition of any one of the seven.

A case of synchisis, with spontaneous dislocation or absorption of the lens, has been already related in the foregoing pages, in some measure for the purpose of directing attention to the state of the refracting apparatus of the eye generally, in altered conditions of the vision; and it seems worthy of remark, that in all cases of alteration in the form of the cornea, but more especially when this tunic remains perfectly transparent, so as to facilitate the examination of the deeper parts of the eye, the condition of the lenticular apparatus should be especially observed, in illustration of which the following case may be shortly related:

Mr. S., æt. 35, a military man, on entering a room appears to be very nearly blind; his loss of sight is the result of three attacks of ophthalmia, in 1841, 1842, and 1844; for each attack he took mercury. The left eye being altogether lost, as to vision,

need not be particularly noticed, but the pathologic condition of the right eye is peculiarly interesting, more especially in connection with the history of the changes which it seems to have undergone.

At the commencement of the present year (1853), he had already been blind of the right eye during eight years, and he now gradually lost the sight of the left, and, as gradually, some sight in the right eye returned.

The question naturally arises, what was the nature and cause of the right side blindness, and how was it removed?

The answer to this question is perhaps more satisfactory than might at first be expected; for, on careful examination of the eye, it is evident that the crystalline lens no longer exists in front of the vitreous humour; it seems probable therefore that a diseased and opaque condition of the lenticular body had shaded the retina from the light; but that afterwards the morbid changes in the lenticular apparatus, and perhaps also in the vitreous humour, had led to the dislocation, the absorption, or to both, of the lens and capsule; after which there no longer remained an opaque centre between the anterior and

posterior humours of the eye, so that the retina could again be reached by the light; although itself not in a perfectly healthy state.

The cornea, in front, has a watery and brilliant aspect, and, when viewed sideways, an unusual degree of prominence is observed; and a deep concave lens being placed before the eye, the patient is surprised at the improvement in his sight. Here we have a case of prominent cornea, although not a case of true conical cornea, where nature seems to have performed the experiment which Sir W. Adams and others have recommended, viz, the operation for causing the absorption of the crystalline lens; but nevertheless, the undue refraction of the rays of light continues, and the concave glass is required. The absence of the lens was determined by the usual optical tests; and, as the patient formerly enjoyed normal vision, its previous existence need not be doubted.

In a remarkable case which came lately under my notice, a young man was thrown, at five o'clock in the afternoon, from the shaft of a cart, upon which he was riding; he appeared to have suffered from a kind of general concussion without having received any injury of importance on the exterior of the body; soon after eight o'clock in the evening, he vomited a great quantity of "pure blood," and an hour later, a second, and similar, attack of hæmatemesis occurred: on the morrow some general indisposition and headache prevailed, and, after ten days, internal strabismus on the right side came on; I saw him ten weeks after the accident, when the squinting was strongly marked, and the vision of the affected eye seriously impaired; it was, however, very gratifying to find that, with the aid of a convex lens of 36 inches focus, the defect of vision was removed.

Here two very interesting considerations present themselves; one relating to the cause of the muscular deviation of the eye; the other relating to the cause of the defect of vision.

Gastric and intestinal irritations, of spontaneous origin, are known to disturb the condition and functions of the eye, and it seems reasonable to suppose that a corresponding morbid change, although of accidental occurrence, might tell upon the state of the visual apparatus, through the medium probably of the par vagum and sympathetic, to say nothing of the indirect connection or continuity of the

mucous membrane of the digestive tube with that of the palpebræ and front of the eye; this therefore may be regarded as one imperfect manner in which it seems not unreasonable to account for the occurrence of the strabismus.

There is little doubt that the normal and wellbalanced action of the ocular muscles exerts some influence on the form, as well as on the position, of the eye-ball; and that, when the globe of the eye is habitually turned far inwards, the traction and pressure exerted upon it, by the united influence of the recti, is unfavourable to the ordinary prominence of the central part of the cornea, which may, in consequence, lose somewhat of its rotundity, however infinitesimal such loss may be, or however incapable of being determined by the unassisted eye of the observer; in this way a slight diminution of the refractive power of the eye, as well as its compensation by the convex lens, may be accounted for; it is, however, to be borne in mind, that in some of these cases, the nervous, as well as the optical or refracting, apparatus undergoes some alteration; the changes, nevertheless, which take place in the latter, seem worthy of especial attention.

In this case a large blister was applied to the region of the stomach, and the surface for some days kept in an irritated condition, by dressing with an ointment containing a small quantity of the Spanish fly; and afterwards allowed to heal, along with the application of a weak unguent of belladonna; the patient took a pill containing the twentieth part of a grain of strychnia three times a day, during a fortnight, the sound eye being bandaged all the while; decided benefit resulted from this treatment; the vision has improved, and the squinting, now barely perceptible, is likely, by perseverence in treatment, to vanish without the aid of surgical operation.

As in cases of squinting, with altered vision, we hope to improve the sight by restoring the balance of muscular action; so, on the other hand, in cases of myopia, if not of conical cornea, lessening the effect of the forward pressure of the ocular muscles, by tenotomy, so as to prevent further lengthening of the eye, anteriorly, or bulging of the cornea, may, at least, be thought of.

Division of the recti muscles of the eye is, perhaps, not unworthy of notice, in connection with the treatment of the early stage of some cases of conical cornea; the section of two opposite tendons, at the same time, leaving the remaining two for after consideration, is the proceeding which suggests itself as amongst the least objectionable; it should, however, be mentioned that, so long as the ocular affection is capable of being relieved by glasses, the proposal of such an operation is likely to be postponed, more especially as the undue prominence of the cornea is, perhaps, in most cases, in a great measure, if not altogether, independent of abnormal muscular action.

A transatlantic invention for altering the form of the cornea, and thus removing defects of vision depending upon its flattened state, has lately been introduced to the notice of the Americans; if it have the effect ascribed to it, of rendering the cornea more convex, it is worthy of consideration whether, in any case, it might bring it into the conical form; for various reasons, however, we think that in this respect it is not to be feared. We proceed to the notice of it with all requisite apology.

It is "an invention of a simple character, by the use of which the sight may be preserved through

life without the use of glasses, or it may be restored after glasses have been worn many years."

"This wonderful effect is produced by an instrument, philosophically constructed, by which the cornea of the eye is gradually raised to its original convexity, causing the focus to impinge on the retina without the aid of convex lenses."

Two such instruments are employed, and are called "Eye-cups." They resemble the instrument employed in this country for dry cupping, or for application to the female breast, but are, of course, smaller; consisting of a hollow sphere of india rubber, very much like that used here as a toy, to which is connected a cup of hard wood, in shape like the receiving part of an egg-cup, the interior of the two communicating, so that, if the india rubber ball be first pressed, and then the edge of the wooden cup be applied to the cheek, closed eyelids, or other part, the sudden expansion of the caoutchouc sphere permits the rarefaction of any atmospheric air which is confined in the apparatus beneath it, and hence of the suction effect. The "Directions for using the cups" are given as follows:

"After pressing a portion of air from the rubber

ball, place the cup centrally over the eye with the lid closed, and then allow the rubber gradually to expand. Occasionally press the cup with the fingers upon the eye as much as can be borne without pain. The first week the cup should be used every night, not exceeding five minutes. The second week the applications may be increased to ten minutes every night. Continue using the cups ten minutes at each application, until the sight is fully restored."

Respecting these instruments, one American medical writer thus expresses himself:

"They are well calculated for that condition of the eye—too great flatness of the globe—which is a frequent cause of imperfect vision, and for chronic weakness of the eye from deficient circulation."

One case in which these cups had been used came under my observation; the patient was a mercantile gentleman, of middle age, who suffered from a defect of vision, which he was led to believe would be remedied by the employment of the new invention; he applied the cups in America, just as he was about to cross the Atlantic; the effect they produced was a black-red state of ecchymosis surrounding the cornea, from blood extravasated apparameters.

rently between the conjunctiva and sclerotic, accompanied with much uneasiness and inability to employ the eyes as usual; this state prevailed during the few days occupied in steaming across to Liverpool, where it gradually disappeared after the employment of astringent collyria along with a little general treatment.

It is probable that, in this case, the cups were not at first employed with sufficient caution; the result, however, which the patient arrived at, points out one method of exciting the circulation of the eye, if this were ever desirable, by removing a little of the atmospheric pressure from the front of it; but it is especially worthy of remark, that, although so much effect was produced upon the circulatory apparatus of the organ of vision, no phenomenon was met with which could be referred to alteration in the figure of the cornea.

It was previously observed, that conical cornea has been spoken of as more common in China than elsewhere, but that, as the malady appears not unfrequently to be a consequence of inflammatory action, it is worthy of remark, that its frequency in certain warm countries is perhaps to be accounted for by the greater prevalence of the ophthalmiæ of those regions; and this, I have lately been able, in some measure, to verify, by the examination of notices relating to this subject, which were published at Canton in 1841.

In the "Chinese Repository" for 1841, vol. x., Mr. Lockhart has given a list of cases of disease of the eye, which were treated at the Hospital of Chusan, of which the following is a copy.

HOSPITAL OF CHUSAN,

Register of Cases from Sept. 23rd, 1840, to Feb. 20th, 1841.

" DISEASES OF THE EYE AND ITS APPENDAGES.

DISEASES OF THE	EYE	AND	ITS .	APPEN	DAGE	is.	
Abscess on Eyelid	•••	•••	•••	• • •	•••	• • •	3
Hordeolum	•••	•••		•••	•••		3
Small tumour of lid	•••	•••	•••	•••	•••	•••	1
Ulcer of lids	•••	•••	• • •	• • •	•••	•••	1
Inflammation of Meibom	ian g	lands	S	•••	•••	•••	1
Trichiasis	•••	•••	•••	•••	•••	•••	144
Entropium (operated on	22)	• • •		• • •		•••	70
Ectropium		•••	• • •	• • •	• • •	•••	35
Contraction of tarsi	•••	•••	•••	• • •	•••	• • •	40
Contraction of tarsi (a	after	nati	ve	operat	ion	for	
entropium)	•••	•••	•••	•••	• • •	• • •	24
Lippitudo	•••	•••	• • •	•••	•••		95
Conjunctivitis	•••	•••	•••	•••	•••	•••	20
Catarrhal ophthalmia, sev	vere	•••	•••	•••	•••	• • •	134
Chronic ophthalmia	•••		•••	•••	•••	••	8
Granular lids, slight opac	city		•••		•••	•••	220
Granular lids, with much	opac	eity	• • •	•••	•••	•••	30
Pterygium (operated on 6	3)	•••	•••	• • •	•••	•••	146
Contraction of puncta lac	chrym	alia	•••	• • •	•••		1
Ulceration of cornea, slig	ght	•••	•••	•••	•••	•••	80
Ulceration of cornea, sev	ere	•••	•••	•••	•••	•••	51
Opacity of cornea		• • •		•••		• • •	311
Opacity of cornea, very	lense.		• • •	•••	•••	•••	8
Staphyloma	•••	•••	•••	•••	•••	•••	12
Abscesses of eyelids ar	nd sca	alp,	caus	ing gr	eat	con-	
traction of eyelids,	and 1	oss o	f vis	sion	•••	•••	1
Loss of vision in both	eyes	, fro	m	$_{ m dense}$	vasc	ular	
opacity of cornea					• • •		2
	Ran	al +	dann	ı		•	1441
	DTOU	igni (ww			••	1441

Brought over 1441										
Loss of vision in one eye, from entropium 1										
Loss of vision in both eyes, from entropium 8										
Loss of vision in one eye, from opacity of cornea 18										
Loss of vision in both eyes, from opacity of cornea 10										
Loss of vision in one eye, sloughing cornea, from										
catarrhal ophthalmia 16										
Loss of vision in both eyes, sloughing cornea, from										
catarrhal ophthalmia 8										
Hernia iridis of one eye 6										
Hernia iridis of both eyes 2										
Closure of pupil, by lymph 1										
Contraction of both pupils to a point 1										
Synechia anterior 4										
Synechia posterior 8										
Cataract, lenticular 6										
Cataract, capsular 5										
Amaurosis 4										
1554''										

Of these 1554 cases, it is very remarkable that more than 1500 are diseases either of the cornea itself, or of parts in connection with the morbid condition of which the cornea is likely more or less to suffer; the list, nevertheless has not one case of conical cornea; but the absence of this affection in one particular report need not be especially insisted upon, if its frequency, as noted in others, be well established.

In the 342 cases given in Dr. Hobson's

register, there is only one case of conical cornea, while about 260 cases of the list are corneal, or circum-corneal, affections.

Mr. Lockhart attributes the great frequency of diseases of the eye, in the Chinese who came under his observation, mainly, to two causes, first, - to inflammation of the organ from exposure to the northerly and north - easterly winds, in October, November, and December, and its consequences; secondly,—to the injurious effects of an every-day practice of the Chinese barbers, who cleanse or "wash" the eyes of the people with an ivory or bamboo instrument, shaped like a small scoop, which they pass under the lids and deeply into the canthi; this "operation" leaves the eye red and irritated, and as if to make the worst of it, the irritation of the eye is but too often attributed to an inadequate cleansing, whence the repetition of the barbarous process, and the additional mischief which follows it.

In Dr. Hobson's "Register of Diseases attended to in M. M. S. Hospital, at Macao, from August, 1840, to July, 1841," the "Diseases of the Eye" stand as follows:

	Catambal and thelesis								0.5
•••	Catarrhal ophthalmia		• • •	•••	• • •	• • •	•••	•••	35
	Chronic ophthalmia .		•••	•••	• • •	• • •	• • •	• • •	21
	Conjunctivitis, acute	and	chron	ic,	•••	•••		• • •	38
	Cataract	• • •	• • •			•••			22
	Entropium	•••				•••	• • •		16
	Ectropium		• • •						4
	Granular lids								43
	Opacity of cornea								35
	Ulcers of cornea .								8
	Staphyloma					•••			5
	D4								28
	T								10
	m data ta da							•••	15
		• • •	•••	• • •	•••	• • •	•••	•••	12
	1 1	• • •	•••	• • •	•••	•••	•••	•••	6
	0.1. 1	• •	• • •	•••	•••	• • •	• • •	• • •	3
		•••	•••	•••	• • •	• • •	• • •	• • •	1
			•••	•••	•••	••	• • •	• • •	6
	v 1	• • •	•••	• • •	• • •	• • •	• • •	• • •	4
	Synechia posterior .	••	•••	• • •	•••	• • •	•••	• • •	1
	Closure of pupil .	••	•••	•••	•••	• • •	•••	• • •	2
	Loss of vision			• • •	• • •				11
	Diseased eyelids .	• •	• • •		• • •	•••	•••		11
	Conical cornea	• • •	•••		•••		•••	•••	1
	Ptosis	• • •	•••	• • •			••,		1
	Tumour of upper lid.								1
	Enlarged caruncula .		•••						1
	Abscess of lachrymal			•••					1
	11000000 of lacing man	Suc							
									342"

Amid these united groups of 1896 cases of diseases of the eye, only one case of conical cornea is found; indirectly, however, the tables are very

interesting, showing, as they do, the great proportion of diseases of the anterior part of the eye, and of the lining of the eyelids, amongst the ophthalmic affections of this part of the eastern world; no one can look over these lists without noticing how much the cornea must suffer in several of the diseases above named, so that, if conical cornea occur more frequently in China than in some other countries, where it has been observed, it is probably, not because there is anything there, which is especially favourable to this particular malady of the tunic, but rather, because circumstances favour the occurrence of diseases of the cornea in general, amongst which, some cases of conical cornea will as certainly occur in China as in Egypt or elsewhere.

The Chinese expression "Gan Fa," or "flowered eyes," is used in the Canton dialect to denote dimness of sight, (Morrison,)—a form of speech not unlikely to be adopted by a people amongst whom opacity of the cornea is often observed; inasmuch as it does not seem to be one of those figurative expressions of Chinese politeness framed for doing honour to old age.

Pathological facts, such as some of the foregoing,

are undoubtedly favourable to the opinion entertained by Jaeger, Jacobs, and others, that conical cornea is frequently observed as a consequence of keratitis, and further, tend to suggest the question, as to whether, or no, the inflammatory condition is not always a precursor of the alteration in form which the cornea, in such cases, undergoes; many cases of conical cornea have, without doubt, been observed, in which no inflammatory action was present, or had been previously recognized; but in others, the practitioner has had good reason to suspect the previous existence of keratitis, the more active phenomena of which had already passed away.

Conical cornea, as occurring in China, has been alluded to as possibly connected with the "pyramidal" or "conical" head of the Chinese people; in connection with which the question might well be asked,—Have the Chinese, generally, a conical or pyramidal head, in those parts of the empire where conical cornea has been observed? I am not able to answer this question in a very positive manner; but may state, that, by one gentleman, who has had good opportunities of observation, in those parts of China which are visited by

the English, I am told, that such is not the case. It is true that some ethnographers speak of the Mongols (a name, as Dr. Prichard observes, very vaguely employed) as a people in whom "the forehead is low and slanting and the head altogether of a square form," (Lawrence;) but it should be borne in mind, that the form of the head which they exhibit "belongs to many very distinct and widelyseparated human races," (Prichard,) amid most of whom conical cornea has yet to be studied; besides which, if conical cornea were any natural or necessary associate of conical cranium, or if the extremely conical cranium had anything to do, if we may be allowed the expression, with the production of conical cornea, the latter ought certainly to be more frequent in countries where the former is regarded as general. Ethnographers describe, and represent, the skulls of the Esquimaux as more pyramidal than others, nevertheless, they do not appear to suffer from conical cornea, in connection with which the two following quotations may be offered, the names of the observers being a sufficient guarantee for the excellence of their remarks.

"The Esquimaux, a race separated into a great

number of hordes, and occupying the shores of the Polar Sea, from Asia, where they exist northwards of Kamtschatka, to Greenland in the west, have the pyramidal, or conoidal, or broad-faced skull, in a most marked degree."—Prichard.

Mr. W. White Cooper says, "Sir John Richardson informs me that he 'observed no cases of conical cornea among the inhabitants of the northern regions of America. Conjunctival ophthalmia is exceedingly common among the Indians and Esquimaux, and often terminates in blindness and opacity; but diseases of the humours, or ball of the eye, are not common."—Sir John Richardson.

The European cases of conical cornea already recorded, in which, at the same time, any remarkable deviation from the ordinary form of the cranium was observed, are undoubtedly interesting, and suggest, as before said, topics for anatomical observation and inquiry; but do not seem hitherto to prove anything more than what we may term a pathological coincidence, so that a conical elevation of the skull, and a conical advance of the eye, cannot yet be fairly introduced to the analogies or homologies of human development.

The diseases of the anterior part of the eye, of the cornea generally, and the cases of conical cornea, in particular, as observed in China, seem fairly attributable, in the main, to causes such as those alluded to by Mr. Lockhart; for the circumstances of country and climate, and the meteorological conditions, which prevail at Chusan and Macao, as well as the habits of the people, are highly favourable to the occurrence of such maladies; and if this potent group of causes be adequately established as such, we shall expect to discover but little in seeking for minor or accidental sources of the same complaints.

Whether, or no, the Chinese practice of shaving the head have any injurious tendency that should here be noted, or whether the head in the shaven state has in any way affected the estimate of its form, we need not step to consider.

It would be interesting to know to what extent tuberculosis, or the characteristics of scrofula, may be met with amongst those who suffer from ocular disease in China; for, if cases of true conical cornea be as frequent in this country, as from some published accounts it would seem, opportunities may hereafter occur, of determining by anatomical and other inquiry, whether or no the cases of conical cornea that come on, as it were, insidiously, and without any well marked phenomena of inflammation, have been preceded or accompanied by any conditions or changes in the affected organ, that could be regarded as belonging to the tubercular diathesis; along with which the ordinary vital actions, as well as the phenomena of disease, so often betray a want of tone and vigour.

No mention of hydrops oculi occurs in the previous reports, whence we may suppose that alterations in the size, form, and position of the cornea, from this cause, are not frequent in China; which, in this respect, may be contrasted with some parts of the north of Africa, where hydrops oculi is said to be endemic, and occasionally hereditary, (Ruete,) but where ordinary myopia is exceedingly rare.—
Furnari.

Hitherto, as is well known, the observation of diseases of the eye has been confined, for the most part, to the lower classes of the Chinese, whose habits are far from being cleanly, whose food is coarse, and whose exposure to the weather and to the smoke of their huts renders them peculiarly liable to the ocular affections from which they are known to suffer; as far, however, as the influences of smoke may be concerned, their condition is not unlike what prevails in some parts of Ireland, and in the north of Europe.

From the hut or tent of many a Lapland mountaineer, the smoke escapes only by chinks in the sides, by a small hole at the top, or by the door-way, during a long night of winter; while the women wear their eyes by needlework, and the men try theirs in making or mending their nets and rein-deer gearing, by a light as miserable as their dwellings. With their skins japanned, and their eyes reddened by smoke, they all at once leave their winter's dark and gloomy abodes, to gaze on snow-clad mountains whence the light of the returning sun is brilliantly reflected; a double exposure, which accounts well enough for the diseased eyes so often found amongst them, and not less for a popular expression well known in Sweden, - "He is as blear-eyed as a Laplander."

From the continued conjunctivitis of the winter months, the young Laplanders mostly recover in the summer, but as age advances, the blear-eyed state becomes an established and permanent condition.

Dr. Magnus Huss and other Swedish writers, who have described these forms of disease, as affecting so commonly the hardy natives of the north, have not dwelt upon conical cornea as one of their associations; this particular malady, however, being relatively so rare, might easily pass unnoticed in any general account; even although this should relate to the ocular complaints of a people who have often something of the peculiar form of head above noticed.

The following case of disease of the eyes, occurring to an English sailor in China, may be thought worthy of mention in this place.

C. B., æt. 30, a robust sailor, consulted me on account of extreme myopia, by which he was attacked three years before, when at Hong Kong; at this time he suffered from headache, dizziness, ocular and orbital pain, which were relieved by bleeding, but left him with extremely short sight, from which he had never suffered before; in this case, the corneæ were very prominent, the anterior chambers apparently large. The shortness of

sight was remedied by spectacles with double concave lens.

The impression of the patient was, that his attack was brought on by exposure to intense heat and light; his symptoms appear to have been those of cerebral and ocular congestion; and the relief from depletion was such as might fairly be expected.

In such a case, the continued application of cold to the eyes, or rather to the closed eyelids, with moderately continued and methodic pressure, such, for instance, as the weight of pledgets of lint, charged with water, applied to the exterior palpebral surface, while the patient remained in the recumbent posture, might probably have been attended with additional advantage; this mode of treatment I have occasionally employed with very apparent benefit, in cases of cerebral and ocular congestion occurring in free livers, or plethoric subjects.

In the ocular affection, above related as occurring in the East, puncture of the eye, for the purpose of evacuating any part of the aqueous humour, seems not to have been indicated, but, in more extreme instances, the practice might at least be thought of; more especially if the cornea were really found to be acquiring the conical form.

The case seems to belong to the class alluded to at page 116, and is one of those that take, as it were, a medium position between an ordinary case of myopia, relieved by concave glasses of low power, and a complete case of conical cornea, such as the first related at page 8; its record in this place seemed the more desirable on account of the place and manner of its occurrence; for although we may be disposed to attribute the cases of conical cornea which have been observed in China to inflammation of the anterior part of the eye, and its consequences, in general, or for the most part, it becomes the more requisite that any special or apparently exceptional cases, or anything that seems to border upon such, should receive that additional attention which their peculiarities may seem to deserve.

It is impossible to determine what was the precise condition of the eye at the time of the attack; that there was anything like keratitis seems somewhat improbable; so that the question naturally enough suggests itself, as to whether, or no, the sources of excitement and increased vascular action to which the patient had been exposed, were sufficient to account for any superabundance in the secretion of the aqueous humour which had not been counterbalanced by a corresponding absorption, and hence had led to an increase of projection in the anterior part of the eye; if such had been the case, it had not led to any accompanying alteration in the state of the iris, which was of dark brown colour, and normal aspect, obeying, in its pupillary motions, the varying conditions of the light; nor was there the slightest visible vestige of any previous inflammatory disturbance of the conjunctiva, cornea, or membrane of Decemet.

ALTERATION in the form of the cornea sometimes follows affections that tell at first upon the conjunctiva; in illustration of which, cases of staphyloma, and conical cornea, more or less like some of those already referred to as occurring after the purulent ophthalmia of children, might be adduced; the following, however, is an instance of a less frequent kind:—

Mr. F., æt. 60, had a severe attack of influenza, when in America, about eight months ago; the left eye suffered at this time, and its cornea is now very conical, and opaque at the centre,—the light is indistinctly seen through the margin of the iris, and cornea, more especially at the outer part; the pupil is contracted, and fixed, and vision of objects is lost.

Conicity of the cornea, in some instances, accompanies keratitis, accidentally, and suddenly, produced, and may disappear with the temporary morbid action which has given rise to it. A young girl, of 18, now under my care, has conicity of the cornea,

which is easily observed in lateral view; she lately received a blow on the eye from a snowball thrown as she was passing along the street; the centre of the cornea seems to have received the main shock, and injury; keratitis followed, and the middle of the cornea has become the apex of the cone which it now displays; the pupil is contracted, and opacity of the lenticular capsule is observed.

Since the preceding observations were written, a very well marked case of conical cornea has come under my notice, in a man of 30; in this instance the conicity of the cornea has been gradually acquired, under the influences of a chronic and long-continued ophthalmia, which commenced as conjunctivitis,—the cornea being subsequently affected; the cone, in one eye, is a little more pointed than that in the other, but the conicity in both eyes is very well exhibited; the anterior surface of the cornea has lost that smooth, polished, or shining aspect, which it has in a state of health,—being roughened by the ulcerative process, but nevertheless imperfectly transparent, except where marked by red vessels, of which there is a little display at the higher part of each cornea. I first saw this patient about twelve months ago, when he had already suffered from ophthalmia for some months, but the cornea had not then acquired that state of conicity which is now observed; so that there is no doubt of the fact, that the conical form of the cornea, which did not formerly exist, has come on during the operation of the influences alluded to.

The pupil is small in both eyes, the blue iris a little dulled in colour; the patient sees well enough to find his way, and to distinguish large objects, but for any finer vision his eyes are useless; the case is highly interesting as another instance of conical cornea observed as a consequence of inflammatory action, and its present aspect is such, that it seems quite possible that, after a lapse of time, when all traces of inflammation shall have disappeared, the cornea might present more or less of that clear, and even glancing appearance, which is met with in certain cases of hyperkeratosis in connection with which keratitis may not have been observed.

The first occurrence of the long-continued ophthalmia is attributed to "cold;" the patient is now a healthy-looking man, but has led an irregular life, and has suffered much from exposure to the weather. With a view of lessening the remains of ocular irritation, a seton in the nape of the neck is recommended; the case having already been met by treatment suited to the indications which have from time to time been obvious. In both eyes the apex of the cone corresponds very nearly to the centre of the cornea; and it would not seem very difficult to account for the occurrence of conicity in such a case; the whole corneal surface, on both sides, having been affected by the inflammatory action, softened, ulcerated, and weakened, the central part of the cornea is more likely to yield to the influences of pressure from behind, than any lateral or circumferential portion of the tunic, supposing the strength at all points to be equal; for, in this particular instance the alteration in the substance of the cornea seems to have been associated with loss from ulceration, and not with gain from new deposit, at least hitherto; and if we suppose that the centre of the cornea was of the same thickness as the circumference, or nearly so, at the time the process of distension, or stretching, or yielding of the corneal tunic began, there would ere long be a somewhat thinned state of this central part, from its new physical condition by pressure from behind, supposing this thinning, however infinitesimal,

not to be compensated for by additional nutrition and deposit; the occurrence of which would not seem to have taken place; in connection with which we may allude to the greater elasticity of the central part of the cornea, noticed by Sir Everard Home, of which further mention will hereafter be made.

A considerable time has already elapsed since the morbid changes in the case here related began; and from the present aspect of the eyes, it seems probable that a gradual and reparative process might yet occupy many months to come, during which the corneal surfaces may be cleared and brightened, while the affected tunic regains something like its former condition of firmness, after which any additional change will be less likely to occur; and here it may be remarked, that when conical cornea has once got into a stationary or quiescent state, it may remain without further alteration during even many years; a truth of which Cappelletti has given a striking illustration in the case which he mentions, where a patient who came under his notice had conical cornea, which, during the previous thirty-six years, had not undergone any appreciable alteration.

If true conical cornea occur suddenly, hemoph-

thalmos might possibly be associated with it, as in cases where it is reported to have arisen, at once, from great efforts or cries, and thus an additional distension of the cornea would be easily accounted for; to which it may be added that in some cases of amenorrhæa, a disease, along with which conical cornea has often been observed,—periodic hæmophthalmos has been noticed, of which a very interesting case is related in the "Practical Work" of Mr. Tyrrell. It is quite obvious that in such cases alteration in the form of the cornea might occur without previous inflammatory action, whatever vascular excitement might be associated with the after-establishment of the keratoconic condition; and also, that these exciting causes of keratoconus, being such as are likely to have their operation very soon suspended, (unless they disturb the balance of secretion and absorption of the aqueous humour,) the amount of effect which they have produced, if not speedily removed, might possibly remain as a permanent condition, and without further change during a considerable length of time.

In many cases of hæmophthalmos suddenly produced by blows on the eye, I have more than once

seen injury of the front of the cornea, by which this tunic may fairly be supposed to have been weakened, as in instances where a thin anterior layer of the membrane has been abraded or scraped away; but the effusion of blood has been gradually absorbed, and the injury of the cornea repaired, without any alteration of form in the front of the eye.

It has been previously mentioned, along with remarks respecting diagnosis in cases of conical cornea, that this affection may sometimes be overlooked, while some other disease is supposed to be present; and this is more likely to happen in the earlier stage, or before the advance of the cone is considerable; and with this notice may be united that of the author of the article "Staphylome," in the "Dictionnaire des Sciences Médicales," who observes, that in some cases the patient sees in a surprising manner, despite a well-marked prominence of the cornea; a fact which, if sufficiently often observed, would suggest an additional caution with regard to diagnosis.

The same writer has given a very interesting case of conical cornea in the right eye of a young girl of 15, who was attacked by a slight ophthalmia

on the right side, after walking in the sun with the head uncovered; the prominence of the cornea was observed on the third day of the inflammatory affection, when there was no remarkable alteration in the transparency of the part; but on the eighth day the apex, or most prominent part of the cone, had become a little dull, and remained so after the disappearance of the inflammation; this condition, however, did not produce any considerable deformity, and the vision was not altogether lost. This case is another illustration of conical cornea occurring as a consequence of inflammation, which, as its author observes, may precede, accompany, or follow this malady; but he also remarks that conical cornea has, in some cases, been altogether unconnected with any inflammatory attack.

The attentive study of the various modes of termination of conical cornea, more especially in cases where surgical operations have not been performed, might supply new and interesting observations bearing upon the nature and treatment of this affection; indeed, it might fairly be said, that our knowledge of the malady is least perfect as far as its two extremes may be concerned; in other words, its beginning

and end, of which relatively little, in the majority of cases, has hitherto been observed; the intermediate part of these cases, or their conditions when sufficiently developed seriously to interfere with vision, having been, for reasons that are obvious, more commonly presented to the view of the surgeon. In connection with some of the cases previously related, that have been treated with success by the employment of general or local remedies, or by both, the question easily arises, as to what the results might have been had the disease been left to the efforts of nature; and although we have not the means of replying in a satisfactory manner, certain sources of information, bearing upon this part of the subject, are suggested by attending to the inquiry.

In a few cases of conical cornea, the progress of which has been from time to time attended to, the alterations observed have taken place most frequently in the apex of the cone, which, from being previously transparent, has afterwards become opaque, and some instances have been reported, in which the apex, after being previously opaque, has regained its former transparency; the latter, however, is undoubtedly the most rare occurrence of the two; and

the causes which seem to favour the progressive opacity have been already alluded to.

One of the most remarkable cases of conical cornea on record is that related by Sanson, in which a spontaneous cure took place after the malady had previously existed during many years.

This distinguished Parisian ophthalmologist was of opinion, that, in cases of conical cornea, the anterior or prominent part of this tunic is hypertrophied, or converted into a solid, thick, and transparent piece; this view, however, is totally incompatible with other notices which occur in his own account of the disease, as the following observations may show:—

Sanson describes conical cornea under the names of "Staphylôme transparent conique. Propulsion conique de la cornée. Hypercératosis." He states that "it sometimes appears suddenly, as a consequence of great efforts, or cries; but oftener its progress is slow, and its cause unknown; however this may be, the apex of the cone, which is generally at the centre of the cornea, is thick, and sometimes slightly opaque, but more frequently transparent."

It is obvious that the name "Conical propulsion

of the cornea" does not accord very well with the idea of thickening or hypertrophy of this part; and if the disease in reality depended upon or were associated with thickening of the corneal tunic, it is not easy to understand how this should be suddenly produced by great efforts or cries. Out of three cases of conical cornea observed by the distinguished surgeon of the $H\hat{o}tel$ -Dieu, one remained unaltered after six months' active treatment; in the second the centre of the cone became softened, and afterwards nearly the whole of the cornea opaque; in the third, and most remarkable case, as above stated, a spontaneous cure took place.

The opinions of Sanson above noticed were published in 1836, and may be contrasted with those of Mr. Guthrie, which appeared several years earlier, in his "Lectures on the Operative Surgery of the Eye." Speaking of conical cornea, Mr. Guthrie says, "I have two cases of this kind under my care at the infirmary, one in a young, the other in a middle-aged man; both eyes are affected in each, without any other appearance of disease save that of a very slight increase of vascularity. The cornea in such cases is decidedly thinner than usual, and if irritation takes

place upon it, the apex of the cone becomes opaque, and causes it to represent in shape a conical total staphyloma. The cause of these two complaints cannot, then, be so essentially different as the German hypothesis would lead us to believe."

This observation of Mr. Guthrie, respecting the gradual conversion of conical cornea into a condition which might be viewed as staphyloma, is evidently of great importance, taken in connection with the pathology or progress of the disease; while the difference between his view and that of Sanson, respecting the morbid anatomy of the cornea in this affection, should even yet attract attention, although the results of recent inquiry tend so much to confirm the accuracy of the opinion published in Mr. Guthrie's valuable work.

It seems worthy of remark, that a thickened state of the anterior part of the tunic, in cases of conical and transparent cornea, would form a lens, which might be found, if sufficiently regular, to possess some of the properties of the meniscus, in connection with the figure and surfaces of which both the refraction and reflection of light would form an interesting study; but this kind of thickening, or lenticular

formation, is undoubtedly a very rare occurrence in cases of conical cornea; nevertheless it might possibly take place as an ulterior consequence, even in cases such as have been here related; for the reparation of an ulcerated state of the front of the cornea might be at length effected through the medium of deposit in or about the depressions previously made by ulceration, by which increase of thickness, and irregularity of surface, might at the same time be favoured; so that, if transparency existed, a refracting lens would be formed, as well as an irregular mirror, or perhaps a cluster of mirrors, in the same structure, in addition to which we may here be allowed to remark that, independent of irregularities of surface from elevations and depressions, the surface of the cornea in cases where this tunic is regularly conical may be regarded as a conical mirror, made up of a series of zones, every one of which has a different curve, and hence a different optical power; any flatter portion met with in certain cases, near to the circumference of the tunic, might be regarded as an accidental irregularity in form, but of which, in the treatment of the disease, an important advantage, in some cases, might possibly be taken.

In connection with the question as to whether the cornea is thinned or thickened in cases of hyperkeratosis, the observation of Jaeger is not to be lost sight of, as in the autopsy of the remarkable case of conical cornea related by him, and which has been previously noticed, the cornea was found abnormally thin at the central part, and abnormally thick in the exterior rim; a state which may perhaps be allowed to suggest the inquiry as to whether there had previously been a thickening of the whole of the cornea, which, at the central part, might afterwards have been thinned by a secondary or subsequent morbid process; to which we may add that a few well-made observations of this kind would at least establish the fact that, in certain cases of conical cornea, an increase of thickness is to be found in a part, if not in the whole, of the affected tunic; but even here, by way of contrast, we must recall to mind the case of Mr. Middlemore, in which, although the apex of the cone was thin, the circumference of the cornea had its normal thickness; as also the case of Mr. Walker, in which "the cornea generally was found very much thinner than natural, and in the centre especially so:" so that the observations of Jaeger and of Walker do not precisely correspond, as even Stellwag von Carion, in his profound work, has stated.

As, possibly, in favour of the occasional occurrence of thickening of the transparent cornea, we may notice the peculiar case related by Stellwag von Carion, in which the front of the right cornea presented a sort of ring of hypertrophy (?) nearly encircling its central part, and of which the features appear sufficiently interesting to warrant the following quotation:—

"Die rechte Hornhaut war wollkommen durchsichtig, allein ihre Krümmung bot ein bisher noch nirgends beschriebenes und auch auf seine Grundursache kaum sicher zurückführbares Verhältniss dar. Es war der Centraltheil der Hornhautvorderfläche von einem bei ½ hohem Walle durchsichtiger Cornealsubstanz umgeben, welcher Wall, sphärisch gekrümmt, fast drei Viertheile eines Kreises von 1½ Durchmesser umschrieb und seine beiden Endspitzen nach abwärts kehrte."

The patient was a pupil in the Institution for the Blind at Brünn (Basin of the Elbe), with opacity of the left cornea, as well as the peculiar disease above noticed; he had some vision, but his history of it could not be relied upon, for, being desirous of leaving the institution, he gave contradictory accounts of his sight, which were characterised by the aspect of falsehood.

Upon the whole, it would seem that the thinning of the central part of the cornea is the pathological condition most uniformly observed, the state of the exterior rim of this tunic having been different in different cases; normal in thickness, abnormally thick, or abnormally thin, as the three cases just cited tend to show; but here we must remark that inasmuch as patients do not die of conical cornea, the anatomical condition of the cornea, which in such cases is met with, after death, should be attentively studied in connection with general morbid conditions, or with the disease of which the patient has died; be this phthisis, as in the case of Jaeger, or other disease likely to alter much the nutritive function in general, or to affect absorption in any particular part; and this remark may be allowed to suggest a practical consideration of some importance, in connection with surgical operations on conical cornea; for it is obvious that the state of the general health, and the

peculiarities of constitution, should here be especially attended to, as previous remarks tend to show; and considering the frequent occurrence of the characteristics of scrofula, along with keratoconus, and the doubtful success of operations upon the eye with such combination of morbid conditions, it is evident that surgical interference should not be resorted to without great circumspection.

Such appearances of the iris and pupil as would be seen through the cornea, were its anterior part thickened into the condition of a transparent lens, would not seem, hitherto, to have been noticed, and as they could not fail to strike any attentive observer, it seems fair to suppose that they have rarely, if ever, been seen by those who have described conical cornea. An approach to the abnormal aspect, which in such conditions the pupil might present, may be seen by forming a fac-simile of conical cornea in glass, with the anterior part, or rounded apex, thickened into lenticular form, behind which, or inside the cone, the central or coloured part of an artificial eye may be placed. With such a meniscus, we shall find the pupil of the artificial eye largely magnified; but this is not the case, if the fac-simile of the cornea, or glass cornea, is either of equal thickness throughout, or thick at the circumferential part, and thin in the middle or apex part of the cone.

Cuvier, in his "Leçons d' Anatomie Comparée," states that the meniscus form is constantly found in the cornea of animals. His interesting remark may here be quoted:—

"Dans tous les animaux, la cornée est composée de lames minces, transparentes, collées ensemble par une cellulosité serrée, et formant par leur assemblage un ménisque plus épais dans le milieu que sur ses bords, et qui peut deja par lui-même faire converger les rayons lumineux."

According to such view, it is obvious that the thickest part of the cornea would be opposite to the thickest part of the sclerotic; in other words, the strongest parts of the ocular shell would be found to correspond to the centre of the cornea in front, and, behind, to that part of the sclerotic which surrounds the optic nerve, where, as is well known, the fibrous membrane in the human eye has its greatest thickness.

The observations of Sir Everard Home and Mr. Ramsden may be placed side by side with the opi-

nion of Cuvier; in allusion to these, Mr. Dalrymple says: "We have the high authority of Sir E. Home and Mr. Ramsden on this subject, who made some very minute and accurate experiments, wherein the result stated was, that the cornea is thickest, as well as most elastic, in its very centre."

Such thickness and elasticity of the central part of the cornea should not be lost sight of in the study of hyperkeratosis.

If, in cases of hyperkeratosis, the cornea is more than usually exposed to the influences of the atmosphere, irritation about the apex of the cone, and consequent opacity, often result; but it is worthy of remark that the mere friction or play of the eyelids upon the healthy cornea, when it is completely and even permanently covered by the palpebræ, does not generally produce such effects; of this statement the following illustration may be given:—

• C. M., a young man of 18, had strumous ophthalmia five years ago, by which he lost the sight of the right eye, not from morbid change in the globe of the eye itself, but from complete union of the tarsal borders of the two lids, the only point at which they were not agglutinated being at the internal cauthus,

close to the puncta lacrymalia; the function of these apertures, and the action of the tears in their situation, seeming to have aided in preventing the adhesion at this part, so that a sort of palpebral pupil, about as large as the iridic pupil of the day-time, was here left, through which the patient could perceive the light when his eye was rolled inwards. The union of the tarsal borders was effected through the medium of a dense and red structure, the product of the granulation at the time of the ophthalmia; a broad director, such as is used in the operation for strangulated hernia, being passed behind this, and from the inner to the outer canthus, the eye-ball was thus protected, and the narrow and hard bond of union divided with the bistoury from behind forwards, and in this way the healthy eye was brought into view; at the outer extremity of the incision a suture was introduced, to eke out the length of the incised opening by a short division, to be gradually effected with the tied thread, which was thus also an agent to prevent the reunion of the separated tarsal margins, and these in addition were touched with the sulphate of copper, and afterwards with a little oil along the incised border. The results were perfectly successful, and the restoration of the sight complete; the cornea being found in a healthy state, and the other parts of the visual organ in equally good condition.

It has been previously shown, that a very small amount of pressure directly or indirectly applied to the cornea, when this structure has acquired an abnormal form, is capable, in some cases, of improving the sight, apparently by altering the curve of the cornea, and thus producing a condition more favourable to that amount of refraction which the exercise of distinct vision requires; and here, on the other hand, it seems worthy of remark, that pressure on the healthy cornea, practised in the same way, may alter distinct vision, so that objects the moon, stars, or comets, for instance—in their apparent size, form, position, or direction, may differ from the reality, by the kind of artificial parallax thus given to them, the measurement of which we need not speak of; but even this may require to be taken into account in connection with the different manner in which celestial bodies are seen by eyes which differ slightly in the forms of their refracting media; a truth which should not pass unnoticed in

connection with physical astronomy, and requires to be considered in its relations to both the vertical and the horizontal curve of the cornea. This interesting subject has received some attention from the illustrious Humboldt, who has found that his view of the stars differs from that of some of his erudite and astronomical friends. (Kosmos.)

Allusion has been previously made to the absence of chromatic aberration in a case of conical cornea, in which the correction of spherical aberration was the main desideratum; and in many cases of hyperkeratosis, the patient may suffer from great defect of vision without being disturbed by false colours, if this expression may be employed; but it is worthy of notice that, in cases such as the one of which the autopsy was published by Jaeger, and where the cornea is found much thinned at the central part, while its outer ring retains its normal, or has even an increased thickness, and where there is what we may call an intermediate and inclined plane of the tunic, uniting the two portions, the thinned, or central part, with the exterior division which remains unaltered or thickened, it is evident that this ring of the cornea, if excised, would have somewhat of a

prismatic form, when viewed in section, although previously without refracting angle, and hence the part presenting such morbid alteration seems worthy of study, in connection with the refraction, reflection, and decomposition of light; although the presence of angular elevations, whether pointed or linear, are undoubtedly rare on the posterior surface of the cornea, but are nevertheless amongst the possible products of ulcerative absorption.

It is known to ophthalmologists that cancerous degeneration, although in such cases very rare, has nevertheless been observed as a termination of staphyloma; hitherto we do not meet with notices of cases of conical cornea terminating in a similar way.

Conical cornea has not as yet received any special attention from writers on legal medicine, although in all systematic treatises on medical jurisprudence, the subject of myopia, real or feigned, receives a notice in accordance with its importance.

From previous remarks it will be understood that the physical signs of transparent and conical cornea, in an early stage, might easily be overlooked by a practitioner not much accustomed to the observation of ocular disease; at a later period, however, the extreme brightness of the cornea when viewed in front, and its figure when seen laterally, along with the myopia, or other alteration of the sight, would scarcely permit it to be either overlooked, or mistaken for any other malady; and although myopia is so often feigned for the purpose of avoiding or escaping from military service, neither soldier nor civilian need attempt to feign the physical characteristics of conical cornea.

In connection with this part of the subject it is worthy of remark, that conical cornea has been frequently met with amongst soldiers, more especially in Flanders, as a result of ophthalmia; and hence would seem to merit the attention of military surgeons. The distinguished Julian Van Roosbroeck, Professor of Ophthalmology in the University of Ghent, has had many opportunities of observing cases of this kind, and he considers that, as a consequence of the ophthalmia of new-born children, of gonorrheal ophthalmia, and of the acute ophthalmia from which military men often suffer, that a softened state of the cornea now and then follows, a "ramoll-issement interstitiel" the true nature of which we

do not understand, but which favours the subsequent occurrence of conical cornea, which may present itself without any accompanying ulceration of the cornea, but which would seem still more likely to happen should such ulceration also exist; to which it may be added, that the observer of the Netherlands has frequently met with conical cornea without any trace of ulceration, and thinks that, as ulceration of the cornea is relatively so common, conical cornea would be much less rare if such ulceration were its essential cause; thus showing how he differs in opinion from a distinguished Parisian oculist, whose observations have been previously noticed.

The treatment of the professor of Ghent is not less interesting than his pathological views; he has tried most of the remedies for this affection, which have been strongly recommended by different writers, but with results less happy than those which the inventors seem to have arrived at. A strong solution of tannin, in Peruvian or oak bark, has now and then seemed of use in his practice; but the deep cauterisation of the centre of the cone, with a pencil-shaped piece of nitrate of silver, is the plan which he has found most efficacious. By this

practice the centre of the cornea, if previously transparent, is made opaque, or, if any opacity at the centre already exist, it is increased; but such new state of central opacity is less injurious to vision than the abnormal conditions which before prevailed with their associated optical interference; while the employment of belladonna is indicated when the margin of the pupil falls within that of the corneal opacity in front of it.

Ulceration of the membrane of Decemet is perhaps very rare; by some its occurrence is doubted; and this tunic is evidently out of the way of many causes of morbid action which tell upon the anterior part of the cornea, where ulceration is so common. Nevertheless, an attentive study of abrasion, rupture, vesication, or ulceration, affecting either face of the cornea, appears to be a matter of some importance to the advancement of our knowledge of hyperkeratosis.

Amongst the varieties of ulceration affecting the cornea, anteriorly, that which has been called the "rheumatic" seems to be here especially worthy of mention, on account of its leaving the cornea with "facettes" on its surface, which now and then give rise to diplopia or polyopia, and which, by

weakening the tunic, might lead to its conical projection.

It has been previously stated that abrasion of the cornea is, in many cases, soon repaired, without any tendency to alteration in the form of this tunic from the partial loss of substance which has taken place; but those painful vesications of the cornea, which have been lately noticed by Mr. Wilde, and which are now and then accompanied by alteration in the quantity, and perhaps in the quality, of the aqueous humour, as well as in the form of the cornea, should not be lost sight of, as capable of leading to a weakened, thinned, or softened state of this part of the eye, and along with which conicity might occur.

The bursting of an abscess, or onyx of the cornea, inwards, into the anterior chamber, is noticed by Mr. T. W. Jones as one source of corneal prominence, of a conical shape; the inner part of the corneal substance being destroyed, and the outer part afterwards incapable of withstanding the pressure from within.

As before remarked, we do not find that the attention of veterinarians has been particularly directed to any disease occurring amongst the lower or domesticated animals, to which the name conical cornea has been given, although conical staphyloma is particularly discussed, and staphyloma, in some treatises, is divided into the transparent and opaque varieties; it is nevertheless more than probable, and analogy seems favourable to the view, that with the progress of the veterinary art, cases of conical cornea will be observed amongst our domesticated animals, whose eyes suffer from a host of diseases which correspond to similar affections of the organ of vision in man.

I have had opportunities of observing alterations of the form of the cornea in the dog, after chronic ophthalmia, as well as dropsy of the anterior chamber of the eye, but have not yet seen a case of true conical cornea in this animal; in more than one instance, however, in carefully-made autopsies, I have found a thinned condition of the central part of

the cornea, which during life had betrayed faint traces of opacity; with increased prominence, yet without conical elevation; but along with which the animal seemed to be nearly blind.

After having paid some attention to the form of the eye in fishes, I was much interested, in the summer of 1852, in observing a case of conical cornea in the eye of a goldfish, which had long been kept in a large glass globe, or vase, the general form of which was that of the glass vessels commonly used to imprison these little animals, but the exterior surface of which was of polyhedral form, from the glass on this aspect being cut into numerous facettes: conditions here mentioned on account of their influence on the transmission, refraction, and reflection of light. The vessel contained two fishes, which differed little in size, form, colour, or general appearance, but in the shape of their eyes a well-marked difference was observed, while the requisite precautions were taken to prevent mistake, or optical illusion, by viewing them in air, as well as in water: in the fish with conical cornea, both eyes were affected. A similar observation made by a friend has induced me to think that this fact has some little interest, so that

its notice may perhaps be excused, although the diseases of the tenants of the waters have hitherto occupied so small a space in the domain of comparative pathology.

Inasmuch as opportunities for the post-mortem examination of cases of conical cornea, in the human subject, are exceedingly rare, it is a matter of some importance to the study of this malady, to extend the inquiry relating to it by any observation of disease of the cornea in the lower creatures which may seem at all allied to hyperkeratosis as found in man; for, in domesticated animals, suffering from complaints of the cornea, with conical prominence of this tunic. the time of the pathological examination might be so chosen as to throw the greatest possible amount of light upon the mode of origin, as well as upon the true nature of the malady; and in this department of observation, any affection of the line of union of the cornea and sclerotic, which is so different in different animals, would invite the attention of anatomists, while the investigation, as a whole, might repay the microscopic inquirer; and if carried on with the aid of treatises on comparative ophthalmology, such as those of Leblanc and Mueller, the value of comparative pathology, so well expressed by Rayer, would, ere long, be more completely established:—

"La pathologie comparée est la pathologie genérale, et je ne puis mieux en faire voir la portée, qu'en rappelant, que la pathologie humaine n'en est qu'un cas particulier."

INDEX.

conical cornea, 118, 251. Abnormal form of head, 34. Abrasion of cornea, 256. Achromatism, 11. Adams, opinion of, 150. Adaptation of eye to surrounding element, 1. Ages, in cases of conical cornea, 3. Ague, with myopia, 117. Alteration in form of cornea, 125. position of pupil, 32, 33. apex of cone, 238. Amaurosis, remarkable case of, 140. Amenorrhœa, with conical coruea, 109. American eye-cups, 210. Amphibia, form of cornea in, 1. Anchyloblepharon, case of, 248. successful operation for, 249. Andreæ, his cases of conical cornea, 114. Animal jelly, lens of, 19. Annular spectacles, 24. Aperture, position of, in artificial iris, 20. Applications, topical, in conical

Aquatic birds, form of coruea in, 1.

Aqueous humor, evacuation of, 21.

increase of, 34.

cornea, 16.

ABERRATION, chromatic, in case of

Arlt on division of the trigeminus uerve, 131. Arsenic, in conical cornea, 15. Artificial eye, appearances of, 191. iris, 8, 18, 20, 71. leus, 18. pupil, 21, 24, 25, 156, 163, 164. teeth, a source of impaired vision, 141. Atropiue, application of, 18. Belgium, conical cornea in, 253. Belladonna, application of, 18. Benedict, opinion of, 151. Birds, form of cornea in, 1. raptorial, form of cornea in, 1. Blindness from foreign body in tooth, 140. Blepharophthalmia, conical cornea after, 117. Blow, conical cornea attributed to, Brain, form of, in case of conical cornea, 43. Breaking up of lens, 23. Broiement of lens, 23. Bruck, Dr., his cases, 185. Budge, his experiments on the sympathetic, 203. Burgman, his case of elongated cornea, 35.

Cancerous degeneration of cornea, 252. Cappelletti, his cases of conical cornea, 234. Carbonate of Iron in conical cornea, 16. Cataract, preceded by myopia, 198. spontaneous cure of, 91. Chelius, on polyopia, 144. China, conical cornea in, 214. Chinese barbers, their operations on the eye, 217. Chinese, lower classes of, diseases of eye in, 224. Chromatic aberration in case of conical cornea, 118, 251. Chlorosis with conical cornea, 109, Chnsan, eye diseases at hospital of, 215. Comparative medicine and conical cornea, 253. Cohesion of eyelids, 248. successful operation for, 249. Collyria in conical cornea, 16. Cold, apparatus for application of, 17. application of, 17. Comedian, case of conical cornea in, 3. Concomitant disease, importance of attending to, 117. Congenital diseases of eye, 37, 181. Cylindric lens, 13. Cnrves of cornea, 250. Conical cornea, after,-

Egyptian ophthalmia, 94.

blepharophthalmia, 117.

keratitis, 148.

Conical cornea, after,hæmorrhoids and iritis, 84. external injury, 98, 196, infantile ophthalmia, 55, 101. inflnenza, 230. iritis, 81, 84. measles, 126. parturition, 40. trichiasis, 121. ophthalmia, 125, 127, 231, 236. Conical cornea,case from Ammon, 40. attributed to blow, 62. a comparatively new name, 5. earliest notices of, 3. equal thickness of, 43. various thickness of, 32. from hooping congh, 58. in an aged clergyman, 107. in an aged female, 104. in connection with comparative medicine, 253. in connection with legal medicine, 252. cases of, 240. cases of Mr. Gervis, 166. cases of Riberi, 148. anti-strumous treatment of, 116. ravity of, 5. observations of, not hitherto numerous, 5. rare in Scotland and northern Germany, 6. observed in Asia, 6. within the tropics, 6.

Conical Cornea, progress of, 26.

remarkable case of, 61.

stationary condition of, 26.

congenital, thickness of,
181.

partial, 103, 104.

relapses, and second cure
of, 115.

Conical cornea, and hysteria, 115. and scrofula, 114. and syphilis, 144. and staphyloma, 241. cylindric lens applied to, 12, 61, 125. cases of Riberi, 148. cases of Andreæ, 114. cured by paracentesis, 155. definitions of, 182. diagnosis of, 186. opinion of Flarer on, 147. instrument for shewing effects of thickness of, 246. question of thickness, 246. in China, 214. imitation of, 190. in soldiers, 253. of long duration, 107, 234. observed by Schön, 118.

> spontaneous recovery from, 239, 240. seton passed into, 158. stages of, 149. supposed accidental origin of, 149.

partial section of, 163.

166.

puncture of substance of,

state of general health with, 245.

Conical Cornea, terminations of, 237. unusually good sight with, 236.

watery aspect of, 188. Conical cornea, with,amenorrhœa, 109. dropsy, 107. chlorosis, 109. chromatic aberration, 118. oscillation of eye-ball, 143. diseased teeth, 138. disease of tarsi, 126. strabismus, 145. tremulous iris, 143, 144. polyopia, 144. hydrocephalus, 146. hydrops oculi, 155. thickening of cornea, 166. hæmophthalmos, 235. entropion, 196. trichiasis, 196.

depressions on, 185. Chelius on polyopia, 144.

Cone, opacity of, opinion of Sichel, 119.

apex of, alterations in, 238. Conical eranium, 35, 53, 54, 56.

Conical eyeball, 187, 188.

Connection of conical cornea and conical cranium, 221, 222.

Conjunctivitis, with myopia, 117.

Cooper, Mr. (W.W.), cases of myopia, 117.

Counter-irritation in conical cornea, 16.

Correction of spherical aberration, 11.

Correction of chromatic aberration, 11.

Corotomia, state of cornea for, 25.

Congenital conical cornea, thickness of, 181. Cornea, thickness of, in the embryo, 28. thickness of, in early life, 29, 181. facettes of, 32. elongated, case of, 35. surgical operations upon, 20. state of, for corotomia, 25. puncture of, 21, 25. excision of part of, 22. form of, altered by ophthalmia, 125. transplantation of, 26, 193. and temporal bone, disease of, 135. and trigeminns nerve, disease of, 135. and sclerotic, connection of, 256. diseases of, in China, 214. very convex, with absorption of lens, 204. concavity on anterior surface of, 154. curves of, 250. difficulty of estimating thickness of, 147. fistula of, 155. flattening of by section, 163. glazing of, 193. hypertrophy of, 166. injury of, with hæmophthalmos, 235.

innervation of, 130.

mirrors of, 242.

meniscus form of, 241.

Cornea, nerves of, 137. nutrition of, 129. observation relating to, of Sir E. Home, 247. of Cuvier, 247. of Mr. Ramsden, 247. peculiar elevation on surface of, 244. puncture of, 166. seton passed into, 158. studied by astronomers, 250. Cuvier, his anatomy of the cornea, 247. DALRYMPLE, his pictorial work, 190. Danish physiologist, his experiments, 134. Darkened glasses, 12. Dazzling brightness of eye, in case of conical cornea, 9. Decemet's membrane, tuberculosis of, 197. Decomposition of light by cornea, Defective eye of children, 36. Definitions of conical cornea, 182. Depressions on conical cornea, 185. Desmarres, his case of myopia, 117. Diagnosis of conical cornea, 186. Diaphragm, optical, 20. Discision of lens, 23. Disease of teeth, with conical cornea, 138. Dislocation of lens, 23. Division of trigeminus nerve, 131. sympathetic nerve, 135.

Dog, disease of cornea in, 254.

Drawings of ocular disease, 189. Dropsy, with conical cornea, 107. EGYPTIAN ophthalmia, conical cornea after, 94.

Electro-magnetism in conical cornea, 16.

Elongation of cornea, 35.

Embryo, human, eye of, 27, 147.

thickness of cornea in, 28.

Entropion, with conical cornea, case of, 196.

Esquimaux, head of, 221.

Evacuation of aqueous humor, 21.

Excision of part of cornea, 22, 160.

External injury, Conical cornea after, 98, 196, 231.

Extraction of lens, 23.

Eye, defective, of children, 36.

Eyeball, conical, 187, 188.

Eye-cups, American, 210.

Eyelids, retraction of, instrument for, 75.

FACETTES of cornea, 32.

from rheumatic ulceration, 255.

Fac-simile of conical cornea, 190. Fario, his operation, 22.

his opinion, 151.

Fish, conical cornea in, 254.

Fischer, his case of conical cornea, 107.

Fishes, form of cornea in, 1.

Flarer, his opinion on conical cornea, 147.

his case of fistula of cornea,

his seton in cornea, 158.

Flat cornea uncommon, 2.

Flattening of cornea by its partial division, 163.

Flattening of cornea, contrivance for, 73.

Fœtus, conical cornea in, 27.

Follin, his ophthalmoscope, 174.

Foreign body in tooth, blindness from, 140.

Form, abnormal, of head, 34, 35, 53, 54, 56.

Form of cornea altered by ophthalmia, 125.

Foveæ, on conical cornea, 185.

Furnari, on myopia in Africa, 224.

GALENZOWSKI, his remarkable case of blindness, 140.

Ganglia of sympathetic, extripation of, 134.

Gasserian ganglion, 131, 132, 133, 135.

Germany (Northern), conical cornea rare in, 6.

Gervis, Mr., his cases of conical cornea, 166.

Girls, their liability to conical cornea, 4.

Glasses, darkened, or neutral tint, 12.

Glass, inserted in cornea, 193.

Glazing of cornea, 193.

Goggles, of wood, perforated, 13.

Granular lids, myopia with, 117.

Guthrie, Mr., his cases of conical cornea, 240.

Hæmophthalmos, with conical cornea, 235.

Hæmophthalmos, with injury of cornea, 235.

Hannover, his experiments, 134.

Head, abnormal forms of, 34. conical, 220.

Helmholz, his "Angenspiegel," or ophthalmoscope, 174.

Himly, opinion of, 149.

Hobson, Dr., his cases of eyedisease in China, 216.

Hong Kong, myopia occurring at, 226.

Hull, Dr., his notice of compound spectacles, 191.

Human eye, form of, 2.

Humboldt, his observations, 251.

Hnmor, aqueous, increase of, 34.

Hnss, Dr. Magnus, on eye-diseases of the Laplanders, 226.

Hydrocyanic acid, in conical cornea, 16.

Hydrops oculi, 60, 185.

with conical cornea, 107, 155.

Hyoscyamus, drops of, to dilate pupil, 57.

Hypertrophy of cornea, 166.

Hysteria and conical cornea, 115. and hydrops oculi, 185.

"Iconographie" of Sichel, 190. Image, inverted by concavity on cornea, 154.

Imitation of conical cornea, 190. Increase of aqueous humour, 34. Infantile ophthalmia, conical cor-

nea after, 55, 101. Influenza, conical comea after, 290. Injury from American Eye-cups,

212.

external, conical cornea after, 98, 190, 231. strabismus after, 206. Innervation of cornea, 130. Instrument for myopia, 77.

for slight pressure on cornea. 73.

Internal ophthalmia, effects of, 85. Iris, artificial, 8, 18, 20, 71.

state of, in case of conical cornea, 10.

snrgical operations upon, 20. tremulous, with conical cornea, 143, 144.

Iron, carbonate of, in conical cornea, 16.

JACOBS, Dr., opinion of, 220.

Jaeger, opinion of, 220.

his case of conical cornea, 45.

Jelly, animal, lens of, 19.

Julian, Van Roosbroeck, on conical cornea, 253.

Keratitis, preceding conical cornea, 148.

Kirkes and Paget, on the sympathetic and fifth nerves, 203.

"Klinischer Unterricht," of Fischer, 107.

Laplanders, diseases of eye in, 225.

Lawrence, Mr., his case of conical cornea, 107.

Legal medicine and conical cornea, 252.

Lens, artificial, 18.

broiement of, 23.

corresponding to form of cornea, 19.

Lens, crystalline, surgical operations upon, 20.

cylindric, 13.

discision of, 23.

dislocation of, 23.

extraction of, 23.

formed of animal jelly, 19.

position and form of, in the young, 37.

spontaneous absorption of, 205.

Lenses, combinations of, 19.

variety of, how employed, 20.

Lockhart, Mr., his cases of Eyedisease in China, 214.

Longet, his researches, 132.

Magnesia, sulphate of, in conical cornea, 15.

Mammalia, form of cornea in, 1.

Mankind, varieties of, in which conical cornea has been observed, 4.

Membrane of aqueous humor, weakness of, 151.

Meniscus lens, 18.

of cornea, 241.

Microscopic inquiry recommended, 259.

Middlemore, Mr., his case of partial conical cornea, 103.

Mirrors of cornea, 242.

Mongols, form of head in, 221.

Muscæ, in case of conical cornea, 61.

Muscles of eye, abnormal attachment of, 41.

Myopia, after ague, 117.

after cold bath, 116. after small-pox, 39.

Myopia, cases of, 76, 198.

during granular state of eyelids, 117.

hereditary, 38.

instruments for, 77.

in the young, 29.

occurring at Hong Kong, 226.

preceding cataract, 198.

source of its name, on, 74. with conjunctivitis, 117.

Nachet, his ophthalmoscope, 17 Nature, question of disease left to,

Neutral tint glasses, 12.

238.

Nerves of cornea, 137.

Nervous system, morbid condition of, state of pupil in, 33.

Nictitation as a symptom of conical cornea, 10.

Nitrate of silver, employment of, 16, 168.

Nussbaum, his insertion of glass in cornea, 194.

Nutrition of cornea, 129.

Object of surgical operations for conical cornea, 20.

Occurrence of conical cornea, modes of, 127.

Ocular and uterine complaints, 113. disease, drawings of, 189.

Opalescence of eye, in cases of conical cornea, 41, 45, 52, 57.

Operation of Fario, 22.

Operations, surgical, for conical cornea, 20.

success of, 162, 163.

Operations, ultimate results of, 165.

Ophthalmia, a source of change in form of cornea, 125.

conical cornea after, 231, 236.

infantile, conical cornea after, 101.

internal, effects of, 85.

Opticiaus, observers of conical cornea, 7.

Oscillation of eye-ball in conical cornea, 143.

Opinion of Adams, 150.

Benedict, 151.

Fario, 151.

Flarer, 147

Guthrie, 241.

Himly, 149.

Pickford, 202.

Sanson, 239.

Sichel, 119.

Ware, 184.

respecting conical cornea, 152.

PAPPENHEIM, his researches, 132. Pickford, Dr., his opinion, 202.

cases of conical cornea, 114.

Pictorial work of Dalrymple, 190.

Photophobia, as a symptom of conical cornea, 10.

Polyopia, as a symptom of conical cornea, 11.

source of, 144, 145.

with conical cornea, 144.

Pourfour du Petit, his division of sympathetic nerve, 135.

Presbyopia, after external injury, 207.

Pressure, 21.

apparatus for application of, 17.

Prichard, Dr., ou the skull of the Esquimaux, 222.

Prognosis, unfavourable, cases for. 143.

Progress of conical cornea, 26.

Prussic acid in conical cornea, 16.

Puncture of cornea, 25, 155, 156, 157.

Pupil, altered in position, 32, 33. artificial, 21, 24, 24.

Recovery, spontaneous, from conical cornea, 239, 240.

Relapses of conical cornea, 115.

Remedies for conical cornea, 15.

Retraction of eyelids, instrument for, 75.

Revielle-Parise, his case of myopia,

Rheumaticulceration of cornea, 255. Riberi, his cases of conical cornea, 148.

Richardson, Sir John, on eyediseases of the Esquimaux, 222.

Roosbroeck, Julian Van, on conical cornea, 253.

Rowley, his case of conical cornea after parturition, 40.

Ruete, on hydrops oculi in Africa, 224.

Rupture, supposed, of posterior layer of coruea, 149.

of membrane of Decemet, 256.

Sanson, opinion of, 239.

Schlemm, his discovery of nerves in the cornea, 137.

Schön, his cases of conical cornea, 118.

Scotland, conical cornea rare in, 6. Scrofula and conical cornea, 114.

Second cure of conical cornea, 115, Seiler, case quoted from, 45.

Sensitiveness of eye, in case of conical cornea, 10.

Seton passed into conical cornea, 158.

Short-sight, preceding cataract, 198. Sichel, his opinion respecting opacity of cone, 119.

his "Iconographie," 190.

Sight, unusually good with conical cornea, 236.

Smith, Dr., his case of myopia, 116 Speck on conical cornea, 184.

Spectacles, annular, 24.

in a case of strabismus, 207.

Soldiers, conical cornea in, 253. Spontaneous recovery from conical cornea, 239, 240.

absorption of lens, 205.

Staphyloma and conical cornea, 241.
Stationary condition of conical cornea, 26.

Strabismus, after accidental injury, 206.

after hæmatemesis, 206. during pregnancy, 114. spectacles, in case of, 207.

with conical cornea, 145.

Sugar-loaf shape of cornea, 184

Sympathy of eye and pelvic viscera 109.

digestive organs, 80.

Synchisis, case of, 86.

in excessive drinkers, 90 Syphilis and conical cornea, 114. Szokalsky, his researches, 132.

Taper, small image of, 63. Teeth, artificial, source of impaired vision, 141.

attention to, 137.

disease of, with conical cornea, 138.

Temporal bone and cornea, disease of, 135.

Terminations of conical cornea, 237. Thickened conical cornea, puncture of, 166.

Thickness of conical cornea, 166. Thickness of conical cornea, various, 32, 59.

of cornea, difficulty of estimating, 147.

of congenital conical cornea, 181.

Tome, on transplantation of cornea, 26.

Tonics, in cases of conical cornea,

Tooth, blindness from foreign body in, 140.

Touch, employed in examination of the eye, 10.

Topical applications in conical cornea, 16.

Traction on eyelid, 18.

Transplantation of cornea, 26, 193

Treatment, anti-strumous, of conical cornea, 116.

Trichiasis, conical comea after, 121, 196.

Trigeminus nerve and cornea, dis ease of, 135.

division of, 131.

Tremulous iris, with conical cornea, 143, 144.

Tuberculosis of posterior surface of cornea, 197.

Tyrrell, Mr., his case,—of periodic hæmophthalmos, 235.

of myopia, 117.

ULCERATION of cornea, 255.

Unfavourable prognosis, cases for, 143.

Uterine and ocular complaints, 113.

Van Roosbroeck, Julian, on conical cornea, 253.

Varieties of mankind, in which conical cornea has been observed, 4. Vesication of cornea, 256.

Veterinary medicine and conical cornea, 257.

treatises, in connection with conical cornea, 4.

Vidal, his case of conical cornea, 104.
Vision, in case of conical cornea,
deceptive to patient, 61.

unusually good with conical cornea, 236.

Vitreous humour, alteration of, 143.

Walther, his cases of conical cornea, 117, 155.

Watery aspect of conical cornea, 188. Winking, as a symptom of conical cornea, 10.

Young people, myopia in, 29.

Zinc, sulphate of, in conical cornea, 15.

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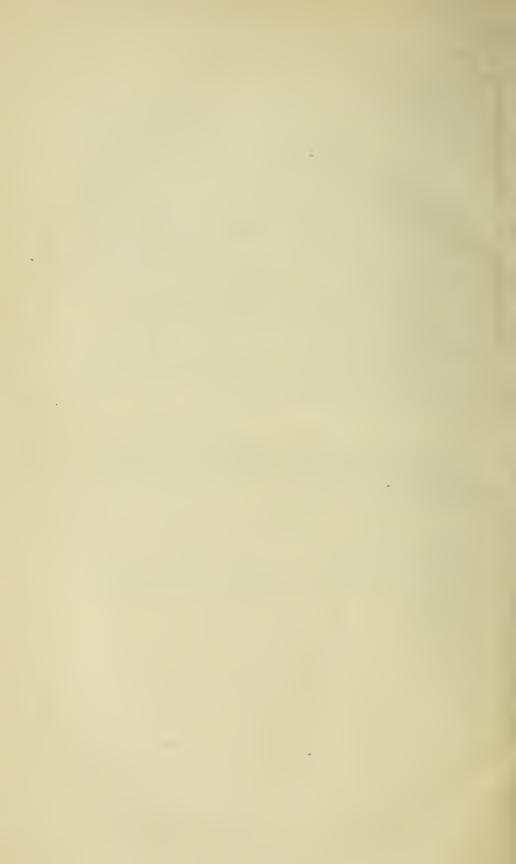
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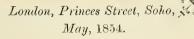
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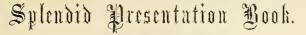
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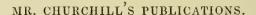
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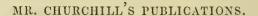
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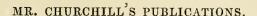
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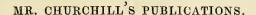
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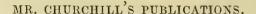
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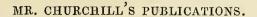
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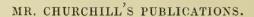
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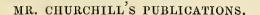
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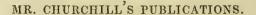
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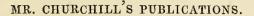
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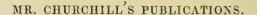
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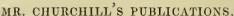
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